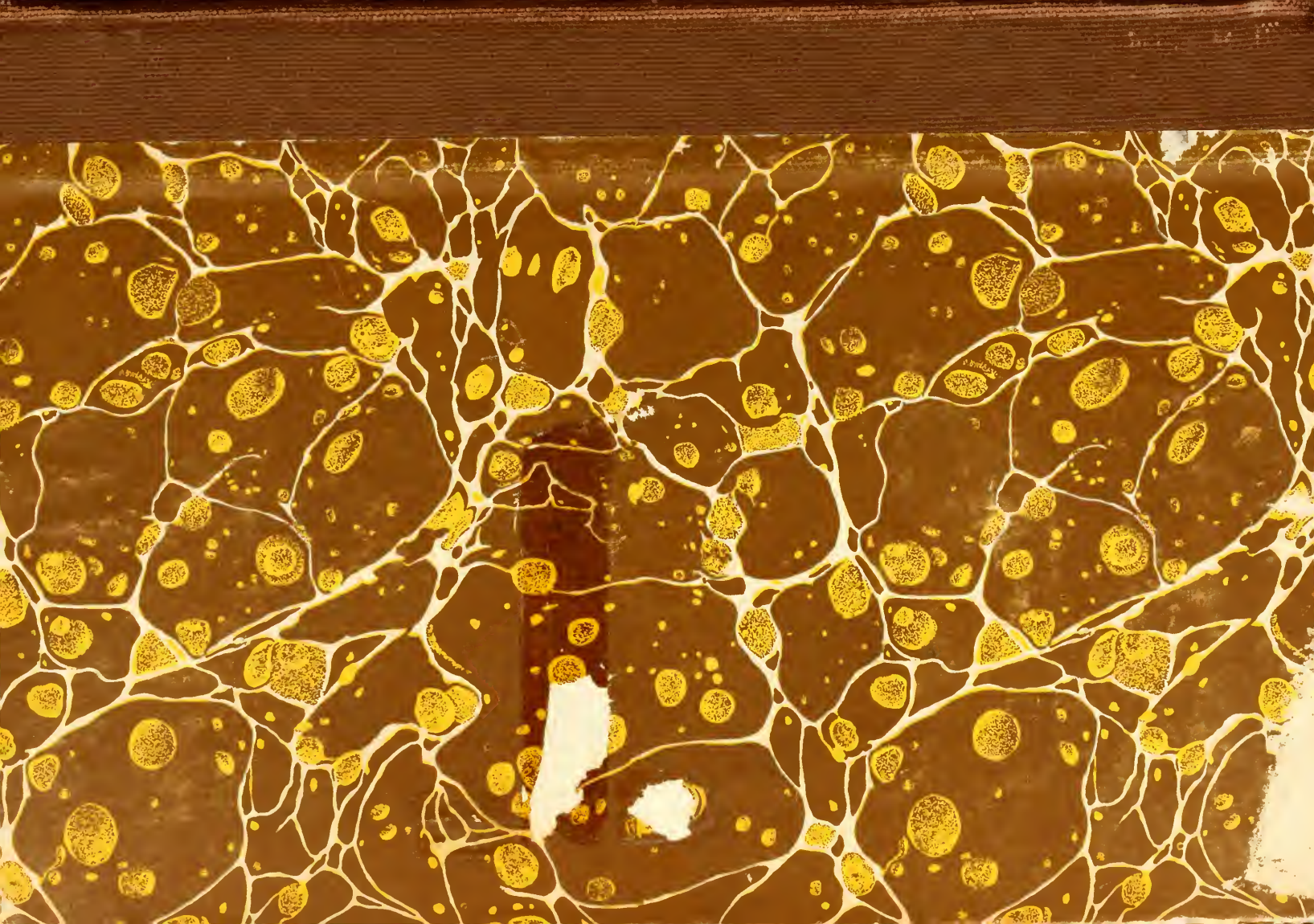

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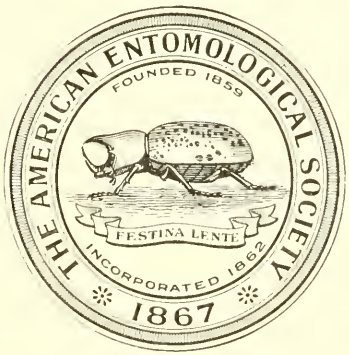


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TRANSACTIONS

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VOLUME XLVIII

# NEW NEOTROPICAL SPECIES OF ENSIGN-FLIES OR EVANIIDAE (HYMENOPTERA)[1]

BY THEODORE H. FRISON

*Urbana, Illinois*

This paper is the result of a study of a collection of Evaniidae, subfamily Evaniinae, collected by Mr. Herbert S. Parish in Brazil and Peru. For a detailed account of this expedition the reader is referred to an article recently published on the crane-flies by Dr. Charles P. Alexander.[2] Briefly: Mr. Parish landed on the Brazilian coast, near the mouth of the Amazon, in the early part of June, 1919. From there he gradually travelled up that river, and several of its tributaries, to Yurimaguas in Peru. Collections were made at various places. Twenty-six specimens of Evaniinae were taken in Brazil at Igarapé-Assú, Prata, Parintins, Obidos, Flores, Teffé, and in Peru at Iquitos and Yurimaguas. Several of these places, such as Teffé (Ega of Bates), and Obidos (Obydos of Bates) are of interest in that they were among the favorite collecting grounds of the great naturalist Bates.

[1] Contributions from the Entomological Laboratories of the University of Illinois, no. 65.

[2] New or Little-Known Crane-Flies from the Amazonian Region. Proceedings Academy of Natural Sciences of Philadelphia, 1921, pp. 39–103, pl. iv.

A brief survey of the literature dealing with these parasitic Hymenoptera, discloses that most of the described species are known from but one or two specimens. Further, that the sexes have not been associated, or in the great majority of cases only a single sex is known. There is always the probability that some species now regarded as distinct may eventually be found to be the opposite sex of some other described species. However, in the majority, if not all, of the known cases where males and females are associated, both have many structural points of agreement, the difference being principally in the antennal measurements, shape of the abdomen, etc. In numerous, cases, particularly in the genus *Hyptia* as previously pointed out by Bradley, the sexes are so similar externally that it is almost impossible to distinguish them without dissecting the specimen. For this reason many previous descriptions are unaccompanied by a statement relative to the sex of the individual under discussion. Familiarity with the biology of these archaic insects would no doubt throw much light on specific limits and sexual dimorphism. Unfortunately the life-histories of but very few of the most common species are known. While the species as a whole are to be regarded as rather rare insects, there is, nevertheless, quite an abundance of species, and more are being added almost every year. Each new collection from the Neotropical, Oriental, Australian and Ethiopian Regions continues to produce new species. Since the rather recent appearance of Kieffer's Monograph[3] over fifty species and varieties have been described.

No intensive study of the morphology of these insects was made. The terminology employed, with few exceptions, is that commonly used in other works relating to this group of insects. The word metanapleura has been used here to denote the pleural area formed by the fusion of the metathorax and the first abdominal segment or propodeum. In many instances it has been difficult to recognize the limits of these two segments on the lateral aspect, and in describing the sculpturing of this area it has been convenient to refer to the area as a whole.

[3] Evaniidae. J. J. Kieffer. Das Tierreich—Schulze. Berlin, 1912. 431 pages.

The problem as to the exact number of genera within the subfamily under discussion is a difficult one. Bradley, in 1908,[4] considers ten genera, whereas Kieffer, in 1912, recognizes only nine. The difference in number is not so marked, but the different criteria as to the validity of the genera are noticeable in many places. For instance the *Evania* of Kieffer comprises the genera *Evania*, *Szepligetella*, *Acanthinevania* and *Evaniella* recognized by Bradley. The generic classification of Bradley takes into consideration the structure of the mouth-parts in conjunction with certain other characters. Kieffer, well aware of Bradley's work, bases his generic classification solely on wing venation. Only an intensive study, supplemented by dissection, of a large series of specimens and species, particularly type material, can be productive of a workable, natural or phylogenetic classification in this group.

Practically all the types of the species of this group from Brazil and Peru are in Europe, and hence it has been necessary to rely solely upon the published descriptions. In many cases the descriptions are so general that several closely allied species may be easily included under a single description. Likewise, it happens, that species easily separable if closely compared run to the same place in the published keys. Thus, whenever the author has dealt with a species which did not thoroughly agree with a previous description, he has described it as a new species. In the opinion of the author it is far better to create a synonym where a description is unrecognizable or characters of importance are not considered, than to list what is probably a new species under an old name. The former course usually brings about a better understanding of the type or species, whereas the latter can only cause confusion, wrong conceptions of geographic distribution, etc.

At this place I wish to acknowledge the many courtesies and suggestions of Dr. Alexander D. MacGillivray, under whose helpful and constant guidance this study was conducted; to Dr. S. A. Forbes, Mr. J. R. Malloch and Dr. C. P. Alexander, for access to the collections of the Illinois State Natural History Survey and for numerous favors; to Dr. F. C. Baker, for the

[4] The Evaniidae, Ensign-Flies, an Archaic Family of Hymenoptera. J. C. Bradley. Trans. Amer. Ent. Soc., XXXIV, 1908, pp. 101–194.

loan of specimens in the Bolter and Nason Collections belonging to the University of Illinois; to Mr. E. T. Cresson Jr., and the American Entomological Society, for many courtesies.

There are representatives of four genera recognized in this article, all based upon specimens from Brazil and three from both Brazil and Peru.

All types are in the collection of the author. Paratypes are in the collection of the American Entomological Society.

### CHALCIDOPTERELLA Enderlein

There is but a single specimen of the genus *Chalcidopterella* Enderlein in the collection, and that is from Brazil. This genus is numerically very small, containing but six described species, all from South America and the West Indies. The genus was erected by Enderlein in 1909, and contains three species listed by Bradley under the name *Evaniellus* Enderlein. The genus *Evaniellus* is now restricted by both Enderlein and Kieffer to a single species. The two genera are distinguished solely by the presence or absence of a trace of the submedian vein. The difference is so slight that recently Brues[5] has described a species from Haiti under the generic name *Chalcidopterella*, which he says could be placed in the genus *Evaniellus* because of the presence of a chitinous fleck denoting the presence of the submedian vein. This he judges is too trivial a character upon which to base a genus.

**Chalcidopterella macgillivrayi** new species

Female. Length, 3 mm.

Head above antennae, cheeks, antennae distad of first flagellar segment, metapleura, propodeum, dorsal half of petiole, abdomen and hind legs distad of trochanters, black. Base of mandibles, pronotum and mesothorax, dark ferruginous. Anterior legs, posterior coxae, posterior trochanters, testaceous.

Head below antennae, first flagellar segment, pedicel, and particularly the scape, dark with a reddish suffusion. Head below antennae with punctures of moderate size, often confluent, the intervals between the punctures of moderate size, often confluent, the intervals between the punctures faintly striate; face separated from the malar space by an elevated, faintly striate carina; malar space about one-third as long as eye and about one-half as long

[5] Three New Species of Evaniidae. Chas. T. Brues. Bull. Amer. Mus. Nat. Hist., xxxv. 1916, pp. 717-720.

as scape; mandibles moderately punctate. Head above antennae with a slightly concave area, with numerous punctures of moderate size, limited on each lateral margin by a row of large punctures and above by numerous large punctures; behind ocelli coarsely punctate. Head viewed from above transversely subquadrate, nearly twice as broad as long, but slightly convex in region of antennal fossae; viewed from the front with vertex slightly rounded, eyes oblique, the distance between them noticeably greater below the antennae than above; ocelli arranged in a triangle, lateral ocelli about twice as far apart as distance from inner margin of eye, area between ocelli punctate; setae sparse, pale. Antennae inserted far below middle of eyes, flagellum clavate, sixth flagellar segment twice as broad as first or pedicel, setaceous; scape over three times as long as distance from its articulation to inner margin of eye, longer than pedicel and first two flagellar segments combined; pedicel as long as first flagellar segment; second and third flagellar segments about equal in length.

Alitrunk somewhat less than twice as long as broad, about one-third longer than high; with numerous pale setae, those on the dorsum and extreme ventral portions longest, short, dense and whitish on truncature. Promotum not forming a collar visible from above, humeral angles rounded. Mesoscutum coarsely punctate, with slight, oblique impressions indicating parapsidal grooves. Mesoscutellum impressed along cephalic margin with adjacent large, deeply set punctures; remaining portion, except mesal part of caudal margin, with large, more scattered punctures. Metanotum narrow, moderately depressed, and coarsely punctate. Propodeum cephalad of articulation of petiole, except for a slightly elevated, polished, impunctate area at base of petiole, with numerous large punctures. Mesopleura with dorsal half, sulcus and anterior swelling, except for very faint punctures, smooth and polished; cephalodorsal angle with a shallow impressed basin; dorsal margin with a row of irregularly shaped punctures. Metapleura with ventral area with large rounded punctures, sharply limited above by an oblique carina and a wide depressed sulcus; dorsad of carina two rows of elongate, narrow, somewhat irregular reticulations; dorsad of this latter an area of large, more rounded reticulations. Truncature concave, reticulate. The articulation of petiole somewhat dorsad of or vertical to metacoxal fossae, the metapleura subquadrate in outline. Metasternal processes parallel. Posterior tibia and posterior tarsus setaceous, longitudinally aciculate; posterior coxa punctate and setaceous on distal half. Outer posterior tibial spur slightly longer than inner, less than one-half as long as the posterior metatarsus; posterior tarsus longer than remaining tarsal segments together; tooth of claw longer and stouter than apical ray. Wings hyaline; front wing with but one closed cell, submedian vein lacking.

Petiole over twice as long as distance from point of articulation to cephalic margin of propodeum; with distinct longitudinal carinae on lateral and dorsal aspects; intervals between carinae with erect pale setae on dorsum, smoother and more polished on latus. Abdomen compressed, smooth, polished and impunctate.

Differs from *C. manni* Brues in having petiole longitudinally carinate and space behind the ocelli punctate. It differs from *C. longistila* Kieffer principally in the comparative length of petiole, tibial spurs, and the prominence of parapsidal grooves.

One specimen, the holotype, from Igarapé-Assú, Brazil, collected on July 16, 1919.

This species is named in honor of Dr. Alexander D. MacGillivray.

**HYPTIA** Illiger

There are six specimens of the genus *Hyptia* in the collection, representing four species. *Hyptia* as here used is equal to *Hyptia* of Kieffer (1912), in which there is only one closed cell in the front wing. It may be noted that Kieffer in his monograph has placed the species *rugosa* Cameron, *cameroni* Schletterer ( = *dorsalis* Cameron), and *guatemalensis* Cameron in the genus *Brachygaster*. All three were originally described by Cameron as *Evania*. Bradley (1908) referred these species to the genus *Hyptia*. This was also the view of Kieffer in 1903, where he says that these species belong to the genus *Hyptia*, but does not give any reason for this interpretation. If the colored figures illustrating Cameron's work are correct, they show that the fore wings of *rugosa* and *cameroni* each possess but a single closed cell, and under Kieffer's own generic key run to *Hyptia*. Likewise there is nothing in the description of these species to suggest that they have three closed cells in the fore wing, as have the members of the genus *Brachygaster*. These species should therefore be placed under *Hyptia*. Although *guatemalensis* Cameron is not figured in the Biologia Central-Americana, according to the description it may be either a *Brachygaster* or *Hyptia*. However, as it is keyed through the same alternative by Cameron as *rugosa* and *cameroni*, the probabilities are that it likewise belongs to the genus *Hyptia*. Kieffer in the work cited above (1912), also places Cameron's species *crassa* under the genus *Evania*. Bradley, in 1908, considered this species as belonging to *Hyptia*, as did Kieffer in 1903. *Crassa* is figured in connection with Cameron's work, and for the same reason as stated above for *rugosa* and *cameroni*, this species can not belong to the genus *Evania*. *Crassa*, as figured,

has only one closed cell in the front wing, whereas the genus *Evania* has seven such cells. The figure also shows another vein, placed as an anal vein. This is very probably only a fold or furrow in the anal region; in which case *crassa* belongs to the genus *Hyptia*. If not a fold or furrow, the illustration depicts a type of wing not noted or found elsewhere in this subfamily.

One specimen, a paratype of *H. spinifera*, was dissected in order to determine the sex. This specimen was a male. As the dissected specimen agreed in all details with the other two, I assume they are also males. The antennae of *H. jucunda* remind one of those of the females of other related genera, and so I have doubtfully considered this species as a female. Without dissecting, I judge two other species of *Hyptia* described here to be males.

### *Key to Species of Hyptia here described*

1. Hind tibia with distinct, long, prominent spinulae; head and thorax entirely or partially ferruginous or fulvous..... 2
   Hind tibia without prominent spinulae; head and thorax entirely black. **jucunda** new species
2. Occipital orbits with a double row of shallow punctures adjacent to the eye; dorsum of petiole with rather coarse punctures interrupting the longitudinal striae.....**spinifera** new species
   Occipital orbits with but a single row of shallow punctures adjacent to the eye; dorsum of petiole with distinct, uninterrupted, longitudinal carinae..... 3
3. Metanapleura and petiole black; truncature with a small, medial, polished area.....**neglecta** new species
   Metanapleura entirely ferruginous, petiole with a reddish suffusion; truncature with reticulations extending over the entire surface. **fraudulenta** new species

**Hyptia jucunda** new species

Female. Length, 5 mm.

Head, thorax, propodeum, pedicel, abdomen and hind legs, black. Flagellar segments distad of first segment greyish-black. Mandibles, scape, pedicel, proximal half of first flagellar segment, tegulae, fore and middle legs, fulvous.

Head below antennae with a small crescentic area of closely-placed, shallow, irregular punctures, ventrad of this area the punctures are coarser, fewer and often confluent; face separated from malar space by a smooth, elevated, impunctate carina; occipital orbits over twice as wide below as above, with a single row of small punctures about mid-way between row of punctures

adjacent to the outer margin of the eye and row limiting lateral aspect of head; malar space about one-third as long as eye, about one-half as long as scape, with scattered coarse punctures; mandibles with a few faint punctures on proximal half, polished. Head above antennae very slightly concave, with scattered punctures of moderate size; area behind ocelli with punctures somewhat smaller than those below. Head viewed from above broader than thorax, transversely subquadrate, about twice as broad as long, but slightly convex in region of antennal fossae; viewed from front with ocellar area not noticeably elevated, eyes slightly oblique; ocelli arranged in a triangle, lateral ocelli nearly three times as far apart as distance from inner margin of eye; with sparse, suppressed pale setae. Antennae inserted very close together, well below middle of eyes, finely, densely setaceous, flagellum somewhat clavate, tapering to distal end, last flagellar segment nearly twice as long as any other flagellar segment; scape in length over three times the distance from its articulation to inner margin of eye, as long as pedicel and first two flagellar segments together; pedicel as long as first antennal segment; second and third flagellar segments of about equal length.

Alitrunk about one-third again as long as broad, about one-sixth again as long as high; with numerous, suppressed pale setae. Pronotum not forming a collar visible from above, humeral angles slightly angular. Mesoscutum with a deep, somewhat rounded impression and a slight indication of parapsidal grooves on cephalic margin, lateral grooves indistinct, with well separated, moderate-sized punctures. Mesoscutellum impressed along cephalic margin adjacent to weak transverse suture with large rather deep punctures; remainder of area with scattered moderately-sized punctures. Metanotum narrow, with punctures of moderate size, except upon middle portion. Propodeum cephalad of articulation of petiole, except for a small, elevated, polished, impunctate area at base of petiole, with numerous moderately sized punctures, abruptly limited laterally by reticulations of lateral aspect. Propleura, except cephalad of tegulae, concave, polished, impunctate. Mesopleura, except for faintly punctate area ventrad of anterior swelling, impunctate, smooth, polished; cephalo-dorsal angle with a shallow, impressed area; caudo-dorsal angle impunctate. Metapleura with a ventral moderately punctate area, sharply limited above by an oblique carina and broad depressed sulcus; sulcus impunctate, polished; dorsad of this latter an area of large, irregular reticulations. Truncature slightly concave, finely, densely setaceous; with a large carinately outlined, vertical, oblong reticulation or depression dorsad of each metacoxal fossa, the space between them somewhat concave, polished and impunctate; area just ventrad of articulation of petiole reticulate. The articulation of petiole almost directly dorsad of or vertical to metacoxal fossae, the metapleura somewhat subquadrate in outline. Metasternal processes slightly divergent at distal ends. Posterior tibia and posterior metatarsus setaceous; posterior coxa above with distal half punctured and wrinkled. Outer posterior tibial spur slightly longer than inner, outer spur less than one-half as long as posterior metatarsus; posterior metatarsus nearly a third again as long as remaining tarsal segments together; tooth of claw not longer than apical ray. Wings hyaline; front wings with one closed subcostal cell, median vein well formed.

Petiole somewhat less than twice as long as distance from point of articulation to cephalic margin of propodeum; with oblique carinae on lateral aspect and longitudinal carinae on dorsal aspect, interrupted by small punctures on dorsal aspect; with sparse suppressed setae. Abdomen compressed, polished.

Closely related to *H. similis* Szeplegeti, from Brazil.

One specimen, the holotype, collected on October 9, 1919, at Parintins, Brazil.

**Hyptia spinifera** new species

Male. Length, 5.5 mm.

Head, scape, pedicel, thorax, propodeum, petiole, legs, except darker distal portion of the hind pair, light-ferruginous. Flagellum, dentes of mandible, abdomen, exclusive of the petiole, black.

Head below antennae moderately punctate, with two elevated, impunctate, oblique faintly striated carinae, interval between the carinae with a row of large punctures; face separated from malar space by the outer of the two carinae; occipital orbits over twice as broad below as above, excepting the two rows of large punctures adjacent to the eyes, but sparsely and moderately punctured; malar space somewhat less than one-half as long as length of eyes, about three-fifths the length of scape; mandibles weakly punctate, polished. Head above antennae nearly flat, coarsely punctate, the punctures much larger than those below; area behind ocelli punctate. Head viewed from above broader than thorax, transversely subquadrate, about twice as broad as long, but slightly convex in region of antennal fossae; viewed from front with vertex weakly rounded, eyes slightly oblique; ocelli arranged in a triangle, lateral ocelli twice as far apart as distance from inner margin of eye; setae erect, light-colored. Antennae inserted below middle of eyes, densely setaceous, flagellar segments of nearly equal thickness throughout; scape with setae longer than on flagellum, finely punctate, length slightly over twice the distance from its articulation to inner margin of eye, slightly longer than pedicel and first two flagellar segments combined; pedicel one-half as long as first flagellar segment; second and third flagellar segments of equal length.

Alitrunk about one-third again as long as broad, somewhat longer than high; numerous erect, golden setae on dorsum and venter. Pronotum not forming a collar visible from above, humeral angles slightly angular. Mesoscutum without parapsidal grooves, lateral grooves weakly formed, with rather numerous, large, rounded punctures. Mesoscutellum impressed along cephalic margin with a transverse row of deep, very large punctures; remainder of area, except for a small, median, impunctate, polished spot, with large punctures. Metanotum narrow, moderately depressed, coarsely punctate. Propodeum cephalad of articulation of petiole, except at very base of petiole, coarsely punctate, sharply limited on each side by reticulations of lateral aspect. Propleura mostly polished and impunctate. Mesopleura with dorsal half polished, impunctate; cephalo-dorsal angle with two large, shallow

impressions; caudo-dorsal angle with a single large puncture; ventral portion and anterior swelling with a few, scattered, rather small punctures, polished. Metumapleura with a ventral coarsely punctate area, sharply limited above by an oblique carina and depressed sulcus; sulcus polished and impunctate, except for several punctures near ventral limits; dorsad of this latter an isosceles-shaped triangular area of somewhat parallel reticulations, limited above by three rows of subquadrate reticulations. Truncature setaceous, nearly flat, with reticulations somewhat similar to those on uppermost of metumapleura. The articulation of petiole almost directly dorsad of or vertical to metacoxal fossae, the metumapleura subquadrate in outline. Metasternal processes rather long and slightly divergent at distal ends. Posterior tibia and posterior metatarsus with long, stiff spinulae among the numerous setae; posterior coxa above punctate and setaceous on distal half. Posterior tibial spurs nearly equal in length, less than one-half the length of posterior metatarsus; posterior metatarsus longer than remaining tarsal segments together; tooth of claw shorter than apical ray. Wings hyaline; front wing with one closed subcostal cell, median vein well formed.

Petiole somewhat less than twice as long as distance from point of articulation to cephalic margin of propodeum; longitudinally and obliquely striate on lateral aspect, striae on dorsum interrupted by coarse punctures; with numerous golden setae on dorsum. Abdomen compressed, polished, with a few pale setae on caudo-dorsal margin of segments.

This species is apparently related to *H. amazonica* Schletterer and varieties, from which it can be separated by the differences in the comparative length of the petiole, color and sculpture.

Three specimens from Parintins, Brazil.

Holotype, October 3, 1919. Paratopotypes, September 27, 1919 and October 10, 1919.

**Hyptia neglecta** new species

Male? Length, 5 mm.

Head above antennae, flagellum, venter of mesopleura, lateral and ventral aspects of metapleura and propodeum, petiole, abdomen and hind legs, black. Head below antennae, greater part of gena, mandibles, scape, pedicel, pronotum, upper portion of mesopleura, mesoscutum, mesoscutellum, metanotum, dorsal portion of propodeum, fore and middle legs, dark ferruginous.

Head below antennae with numerous punctures of moderate size, somewhat arranged in arcs, face with a small tubercle on middle portion; face separated from malar space by a smooth, elevated ridge; occipital orbits over twice as wide below as above, except for a few, scattered punctures, bare and polished; malar space more than one-third the length of the eyes, over one-half as long as scape; mandibles with a few punctures on proximal half, polished. Head above antennae nearly flat, with punctures slightly larger than those on face, arranged in arcs; area behind ocelli with three transverse rows of rather large punctures, between the ocelli mostly impunctate, polished. Head viewed

from above broader than thorax, transversely subquadrate, about twice as broad as long, but slightly convex in region of antennal fossae; viewed from the front with ocellar area distinctly elevated, eyes slightly oblique; ocelli large, arranged in a triangle, lateral ocelli nearly three times as far apart as distance from inner margin of eye; with scattered golden setae, longest on face. Antennae inserted well below middle of eyes, densely, finely setaceous, flagellar segments of nearly equal thickness through out; scape with setae longer and more sparse than on flagellum, length over twice distance from its articulation to inner margin of eye, longer than pedicel and first two flagellar segments together; pedicel slightly over one-half as long as first flagellar segment; second and third flagellar segments of equal length.

Alitrunk one-third again as long as broad, slightly longer than high; with numerous, erect golden setae. Pronotum not forming a collar visible from above, humeral angles somewhat angular. Mesoscutum without parapsidal or lateral grooves, with numerous, large, rounded punctures. Mesoscutellum impressed along cephalic margin adjacent to transverse suture with large, deep punctures; remainder of area with large rounded punctures. Metanotum narrow, moderately depressed, coarsely punctate. Propodeum cephalad of articulation of petiole, except for a small, elevated, polished, impunctate area at base of petiole, with punctures somewhat smaller than those on mesoscutellum, limited laterally by reticulations of lateral aspect. Propleura mostly polished and impunctate. Mesopleura with dorsal half impunctate, polished, with a few oblique, rather carinate ridges; cephalo-dorsal angle with several shallow impressions; caudo-dorsal angle with a single, large puncture; anterior swelling with a row of small punctures parallel to depressed sulcus, punctures cephalad and ventrad more numerous and minute. Metapleura with a ventral coarsely punctate area, sharply limited above by an oblique carina and depressed sulcus; sulcus impunctate, except for a row of large punctures adjacent to the ventral limits; dorsad of this latter an area of fine, irregular, oblique carinae, limited above by large, irregular, subquadrate reticulations. Truncature setaceous, nearly flat, reticulate, except for a small, bare, polished area below middle on the central portion. The articulation of petiole almost directly dorsad of or vertical to metacoxal fossae, the metapleura subquadrate in outline. Metasternal processes divergent at distal ends. Posterior tibia and posterior metatarsus with long stiff spinulae among the numerous setae; posterior coxa punctate on distal half, setaceous. Posterior tibial spurs almost equal in length, somewhat over one-third the length of posterior metatarsus; posterior metatarsus much longer than remaining tarsal segments together; tooth of claw shorter than apical ray. Wings hyaline; front wing with one closed subcostal cell, median vein well formed.

Petiole slightly over twice as long as distance from point of articulation to cephalic margin of propodeum; with sharp longitudinal carinae on dorsal and lateral aspects, with a few, weak punctures between the striae; sparsely setaceous. Abdomen compressed, polished, with a few pale setae on dorsum.

In many respects similar to *H. nigriventris* Szeplegeti and *H. amazonica* Schletterer, from Brazil, but differs from the descrip-

tions of those species in many ways, such as the comparative length of the petiole, malar space, tibial spurs, punctuation, etc.

One specimen, the holotype, collected May 4, 1920, at Iquitos, Peru.

**Hyptia fraudulenta** new species

Male? Length, 5 mm.

Head in region of ocelli, pedicel, flagellum, dentes of mandibles, hind legs, and abdomen, black. Remainder of head, mandibles, scape, thorax, fore and middle legs, posterior coxa and posterior trochanter, ferruginous. Petiole mainly ferruginous, but with a black suffusion above.

Head below antennae with numerous punctures of moderate size, intervals between punctures finely striated, tubercle on face very small; face separated from malar space by a smooth, elevated, impunctate ridge; occipital orbits over twice as wide below as above, except for a few, scattered, large punctures, bare and polished; malar space over one-third the length of eye, two-thirds the length of scape; mandibles with a few shallow punctures on proximal half, polished. Head above antennae nearly flat, with punctures of same size as those below, but somewhat arranged in ares; area behind ocelli longitudinally wrinkled and punctate. Head viewed from above broader than thorax, transversely subquadrate, about twice as broad as long, but slightly convex in region of antennal fossae; viewed from front with ocellar area elevated, eyes slightly oblique; ocelli large, arranged in a triangle, lateral ocelli nearly three times as far apart as distance from inner margin of eye; with sparse golden setae. Antennae inserted below middle of eyes, densely, finely setaceous, flagellar segments slightly bead-like or moniliform, the fourth flagellar segment less than twice as broad as the first; scape with setae somewhat longer and more sparse than those of flagellum, length nearly three times the distance from its articulation to inner margin of eye, as long as pedicel and first two flagellar segments together; pedicel about one-half as long as first flagellar segment; second and third flagellar segments of equal length.

Alitrunk about one-third again as long as broad, little longer than high; with numerous, golden setae. Pronotum not forming a collar visible from above, humeral angles somewhat angular. Mesoscutum without parapsidal or lateral grooves, with numerous, large, rounded punctures, those on the very median cephalic margin smaller. Mesoscutellum impressed along cephalic margin adjacent to transverse suture with large, deep, punctures; remainder of area, except for a small, elevated, polished, impunctate area at base of petiole, with moderate-sized punctures limited laterally by reticulations of lateral aspect. Propleura mostly polished and impunctate. Mesopleura with dorsal half impunctate, polished; cephalo-dorsal angle with a shallow, impressed area; caudo-dorsal angle with a single, weak, rounded puncture; ventral portion and anterior swelling sparsely and finely punctate. Metapleura with a ventral coarsely punctate area, sharply limited above by an oblique carina and a narrow depressed sulcus; sulcus

polished, with a few large punctures along cephalo-ventral limits; dorsad of this latter an area of fine, irregular, oblique carinae, limited above by several rows of irregular, subquadrate reticulations. Truncature nearly flat, setaceous, entirely covered with reticulations. The articulation of petiole directly dorsad of or vertical to metacoxal fossae, the metunapleura subquadrate in outline. Metasternal processes slightly divergent at distal ends. Posterior tibia and posterior metatarsus with long, stiff spinulae, among the numerous pale setae; posterior coxa above with proximal half impunctate, polished, distal half finely punctate and setaceous. Posterior tibial spurs almost equal length, a little over one-third the length of posterior metatarsus; posterior metatarsus much longer than remaining tarsal segments together; tooth of claw shorter than apical ray. Wings hyaline; front wing with one closed subcostal cell, median vein well formed.

Petiole slightly over twice as long as distance from point of articulation to cephalic margin of propodeum; with sharp longitudinal carinae on dorsal and lateral aspects, intervals between carinae on dorsal and lateral aspects, intervals between carinae polished, almost impunctate; moderately setaceous. Abdomen compressed, polished, with a few pale setae on dorsum.

One specimen, the holotype, collected July 1, 1919, at Prata, Brazil.

**BRACHYGASTER** Leach (=*Semacomyia*)

The genus *Brachygaster* is represented by seven specimens, six of which are from Peru and one from Brazil. Bradley, in 1908, erected the genus *Semacomyia* for the Neotropical species of certain *Evania* and *Brachygaster* of authors. Bradley also proposed *Semacodogaster* for the one species of *Brachygaster* occurring in Europe, saying *Brachygaster* was a nomen nudum. According to Kieffer the European *B. minuta* Olivier is congeneric with the South American species. Viereck, in 1914[6], retains the name *Brachygaster*.

One specimen of this genus is not included in my key or descriptions, as it is badly mutilated. It is a female and was collected by Mr. Parish on May 18, 1920, at Iquitos, Peru. Apparently it is closely related to my *peruviana* and runs to that species in the following key. However, it readily can be separated from *peruviana* in many ways and probably represents another new species.

[6] Type Species of the Genera of Ichneumon Flies. Henry L. Viereck, Bull. 83, United States National Museum. 1914. 186 pages.

*Key to Species of Brachygaster here described*

1. Petiole and thorax entirely ferruginous or fulvous; species from 6 to 8 mm. in length ..... 2
   Petiole dominantly black, thorax entirely or partially black; species not over 4.5 mm. in length ..... 3
2. Alitrunk nearly twice as long as high; head above antennae with a concave, somewhat faintly, transversely striate, mesal area .... **rubia** new species
   Alitrunk about one and one-half times as long as high; above antennae nearly flat, coarsely punctate ..... **peruviana** new species
3. Metunapleura with an oblique polished, impunctate area; thorax not entirely black ..... 4
   Metunapleura without an oblique polished, impunctate area; thorax entirely black ..... **angustata** new species
4. Humeral angle rounded, pronotum not forming a narrow collar visible from above; caudo-dorsal angle of mesopleura with some large punctures. **eximia** new species
   Humeral angle angular, pronotum forming a collar visible from above; caudo-dorsal angle of mesopleura impunctate, polished. **parishi** new species

**Brachygaster rubia** new species

Female. Length, 8 mm.

Head, mandibles, scape, pedicel, first two and proximal portion of third flagellar segments, thorax, propodeum, petiole and legs ferruginous, particularly above antennae nearly carmine. Dentes of mandible, flagellum distad of proximal portion of third segment and abdomen, black.

Head below antennae with coarse, irregular, often confluent punctures and a small, slightly elevated, impunctate tubercle on clypeus; face separated from malar space by a distinct, elevated, impunctate carina which extends from upper angle of the base of the mandible upward along inner margin of eye as far as antennae; occipital orbits greatly constricted above and one-half as wide below as length of the scape, with a few scattered punctures of moderate size; malar space about one-fifth as long as eye, less than one-third as long as scape, with several moderately-sized punctures; mandibles weakly punctate. Head above antennae with a concave, somewhat faintly transversely striate mesal area, limited laterally and above by coarse, irregular, often confluent punctures; area behind the ocelli with some punctures, much smaller than those below. Head viewed from above much broader than thorax, transversely subquadrate, about twice as broad as long, noticeably convex in region of fossae; viewed from front with ocellar area not elevated, eyes almost parallel; ocelli arranged in a triangle, lateral ocelli about twice as far apart as distance from inner margin of eye; with numerous golden setae, largest and most abundant below antennae. Antennae inserted close together well below middle of eyes, finely, densely setaceous, flagellum clavate, tapering to distal end, ventral surface of clavate segments flat, scape finely,

densely punctate, in length six times distance from its articulation to inner margin of eye, somewhat longer than pedicel and first flagellar segment together; pedicel less than one-half as long as first flagellar segment, longer than wide; second flagellar segment nearly as long as first flagellar segment and pedicle together, about one-third again as long as third. Antennal fossae with lateral rims elevated, polished, impunctate.

Alitrunk nearly two and one-half times as long as broad, almost twice as long as high; with numerous golden setae, most abundant ventrally. Pronotum forming a very narrow collar visible from above, much wider laterally, humeral angles slightly angular. Mesoscutum with distinct, almost parallel parapsidal grooves, lateral grooves but weakly impressed; densely, minutely punctate along cephalic margin, remainder of area, except for a few small punctures along parapsidal grooves, impunctate and highly polished. Mesoscutellum impressed along cephalic margin adjacent to transverse suture by a row of moderately large, subquadrate punctures; remainder of area finely and densely punctured laterally, disk polished and with scattered small punctures. Metanotum comparatively long, nearly as long as pedicel, coarsely reticulate. Propodeum cephalad of articulation of petiole reticulate, except for a small, elevated, finely longitudinally striated area on middle portion near cephalic margin and a small elevated, polished impunctate area at base of petiole. Propleura punctate about humeral angle, lower two-thirds concave impunctate, polished. Mesopleura with dorsal half, except for small impressed area in cephalo-dorsal angle, impunctate and highly polished: anterior swelling and ventral portion with small scattered punctures and numerous minute punctures; caudo-dorsal angle with an oblique row of several punctures; sulcus prominent. Metapleura with a ventral moderately punctate area, limited above by an oblique carina and shallowly depressed, impunctate, polished sulcus; dorsad of this latter an area with rows of irregular, subquadrate reticulations. Truncature nearly flat, with numerous golden setae, coarsely reticulate. The articulation of petiole two-thirds of length of petiole cephalad of metacoxal fossae, metapleura subquadrate and about one-half the length of petiole caudad of base of petiole, abruptly sloping off to metacoxal fossae. Metasternal processes long, slender, distal ends slightly divergent. Posterior tibia and posterior metatarsus with prominent aciculae among numerous setae; posterior coxa above sparsely, moderately punctate, polished. Inner posterior tibial spur twice as long as outer, and one-half as long as posterior metatarsus, posterior metatarsus longer than remaining tarsal segments together; tooth of claw much longer and stouter than apical ray. Wings hyaline, front wings with three closed cells.

Petiole slightly over twice as long as distance from point of articulation to cephalic margin of propodeum; striate and reticulate on lateral aspect, dorsum with scattered coarse punctures more numerous on the distal half; with sparse golden setae. Abdomen depressed, polished, with a few pale setae at apex.

The largest species of this genus thus far described.

One specimen, the holotype, collected April 26, 1920, at Yurimaguas, Peru.

This species is named for my wife, who has helped me in the typing of this and many other manuscripts.

**Brachygaster peruviana** new species

Female. Length, 6 mm.

Head, mandibles, scape, pedicel, first three flagellar segments and proximal half of fourth segment, thorax, propodeum, petiole and legs, fulvous or ferruginous. Abdomen, exclusive of petiole, dentes of mandibles and flagellum distad of middle of fourth segment, black.

Head below antennae, except for a bare interantennal line extending ventrad of antennae, with many punctures of moderate size; face separated from malar space by a distinct, elevated, impunctate carina, which extends from near upper angle of the base of mandible upward along inner margin of eye as far as antennae; occipital orbits greatly constricted above and about one-half as wide below as length of scape, polished, almost impunctate; malar space somewhat less than one-third as long as eye, slightly less than one-third as long as scape, with several small punctures; mandibles weakly punctate. Head above antennae nearly flat, coarsely punctate, with punctures gradually diminishing in size and number on vertex and occiput; area behind ocelli with small sparse punctures. Head viewed from above broader than thorax, transversely subquadrate, about twice as broad as long, noticeably convex in region of antennal fossae; viewed from the front with ocellar area but slightly elevated, eyes slightly divergent below; ocelli arranged in a triangle, lateral ocelli about twice as far apart as distance from inner margin of eye; sparse, golden setae. Antennae inserted rather far apart and far below middle of eyes, finely, densely setaceous, clavate from third flagellar segment, tapering gradually again to distal end, ventral surface of clavate segments rounded; scape finely, densely punctate, in length five times distance from its articulation to inner margin of eye, about the length of the pedicel longer than pedicel and first flagellar segment together; pedicel one-half as long as first flagellar segment, twice as long as wide; second flagellar segment not as long as pedicel and first flagellar segment together, much longer than the third. Antennal fossae with lateral rims convex, polished, impunctate.

Alitrunk twice as long as broad, about one-half again as long as high; with numerous golden setae, most abundant ventrally. Pronotum forming a very narrow collar visible from above, humeral angles rounded. Mesoscutum with distinct parapsidal and lateral grooves; sparsely punctate along cephalic margin, remainder of area, except for a few scattered punctures much larger than those cephalad, impunctate and polished. Mesoscutellum impressed along cephalic margin adjacent to transverse suture by a row of large subquadrate punctures; remainder of area polished, with scattered punctures of smaller size. Metanotum narrow, coarsely punctured. Propodeum cephalad of articulation of petiole with a few large, oblong punctures along cephalic margin, disk polished, limited laterally by reticulations of lateral aspect. Propleura concave, finely punctate and slightly wrinkled cephalad of attachment of front wing, minutely punctate and polished below. Mesopleura with dorsal half polished and impunctate, except for two elongate,

setaceous impressions; anterior swelling and ventral portion finely punctate, polished; caudo-dorsal angle with a crescentic row of punctures, ventral punctures largest; sulcus prominent. Metapleura with a ventral coarsely punctate area, limited above by a polished, impunctate area; dorsad of this latter an area of large, irregular, somewhat elongate reticulations; dorso-cephalic angle, ventrad and caudad of articulation of hind wings densely setaceous; oblique sulcus very shallow. Truncature nearly flat, coarsely reticular, with numerous golden setae. The articulation of petiole far cephalad of metacoxal fossae, truncature gradually sloping off from above to the metacoxal fossae. Metasternal processes long, slender, nearly parallel throughout. Posterior tibia and posterior metatarsus with prominent longitudinal rows of aciculae among the dense setae; posterior coxa above polished, sparsely, finely punctate. Inner posterior tibial spur much longer than outer, about one-half the length of posterior metatarsus; posterior metatarsus longer than remaining tarsal segments together; tooth of claw much longer and stouter than apical ray. Wings hyaline, front wings with three closed cells.

Petiole somewhat less than three times as long as distance from point of articulation to cephalic margin of propodeum; with a band of reticulate punctures on lateral aspect, dorsum with some small punctures, sparsely setaceous. Abdomen compressed, polished, with a few pale setae on caudo-dorsal margins of segments; ovipositor lighter in color than abdomen, at apex with numerous short setae.

Easily separable from the three previously described species of this genus from Peru because of the presence of a carina separating the face from the malar space. Other species having certain characters in common are *B. basalis* Schletterer from Colombia, *B. amazonica* Roman from Brazil and *B. guyanensis* Cameron from British Guiana.

One specimen, the holotype, collected April 16, 1920, at Yurimaguas, Peru.

**Brachygaster angustata** new species

Male. Length, 4.5 mm.

Head above antennae, occipital orbits, flagellum, pedicel, thorax, propodeum, petiole, abdomen and hind legs, black. Head below antennae, proximal portion of mandibles, scape, and anterior legs, fulvous.

Head below antennae densely and rather finely punctate; face separated from malar space by a weakly elevated setaceous carina; occipital orbits, somewhat wider below than above, about as wide below as length of scape, polished, with a few small scattered punctures; malar space about as long as scape, over one-third as long as eye, polished, with several small scattered punctures; mandibles polished, weakly punctate. Head above antennae nearly flat, densely and finely punctate; area behind ocelli polished, with a few small, scattered punctures. Head viewed from above broader than thorax, transversely subquadrate, broader than long, but slightly convex in

region of antennal fossae; viewed from the front with ocellar area but slightly elevated, eyes somewhat divergent below; ocelli arranged in a triangle, lateral ocelli about twice as far apart as distance from inner margin of eye; with numerous golden setae, more abundant and longer below antennae. Antennae inserted close together and below middle of eyes, finely setaceous, flagellar segments of about equal thickness throughout, scape finely punctate, in length three times the distance from its articulation to inner margin of eye, as long as pedicel and first flagellar segment together; pedicel about one-half as long as first flagellar segment, slightly wider than long; second flagellar segment longer than the first, third and second segments of nearly equal length.

Alitrunk nearly three times as long as broad, nearly twice as long as high; with numerous whitish setae. Pronotum not forming a collar visible from above on the same plane as the mesoscutum, but with neck noticeably lengthened; humeral angles rounded, finely punctate. Mesoscutum with distinct parapsidal grooves; finely punctate along cephalic margin, remainder of area, except for a row of small punctures adjacent to parapsidal grooves, polished and impunctate. Mesoscutellum slightly convex, with scattered punctures of moderate size. Metanotum narrow, coarsely sculptured. Propodeum cephalad of articulation of petiole coarsely reticulate. Propleura finely punctate and striate. Mesopleura with dorsal half, except for irregular impressions in cephalo-dorsal angle, somewhat polished and impunctate; anterior swelling and ventral portion finely punctate; caudo-dorsal angle with several large punctures. Metapleura with a ventral coarsely punctate area, limited above by a finely transversely-striate area which in turn merges with a dorsal irregularly reticulate area; with but a faint trace of the oblique sulcus. Truncature reticulate, plainly convex, with numerous whitish setae. The articulation of petiole far cephalad of metacoxafossae, nearly dorsad of or vertical to mesocoxal fossae, the truncature gradually sloping off from above to metacoxal fossae and when viewed from the lateral aspect somewhat triangular in outline. Metasternal processes rather long, slender and parallel. Posterior tibia and posterior metatarsus with some rows of aciculae among the dense setae; posterior coxa above rugose. Inner posterior tibial spur somewhat longer than outer, about one-third the length of posterior metatarsus; posterior metatarsus longer than remaining tarsal segments together; tooth of claw stouter but not longer than apical ray. Wings hyaline, front wings with three closed cells.

Petiole three times as long as distance from point of articulation to cephalic margin of propodeum, somewhat reticulate on lateral aspect, dorsum polished, with several fine punctures, very sparsely setaceous. Abdomen compressed, smooth and polished, with a few light-colored setae on caudo-dorsal margins of segments.

A very slender proportioned species.

One specimen, the holotype, collected April 13, 1920, at Yurimaguas, Peru.

**Brachygaster eximia** new species

Male. Length, 4 mm.

Face, cheeks, proximal portion of mandibles, anterior legs, and proximal portion of posterior trochanters, fulvous. Vertex, occiput, pro-and mesothorax, and propodeum between articulation of petiole and cephalic margin, dark ferruginous. Antennae, metathorax, propodeum, petiole, abdomen and hind legs black, but in places with a reddish suffusion.

Head below antennae finely punctate, with a small, elevated carina extending from antennae ventrad to a small polished tubercle on face; face not distinctly separated from malar space by a carina; occipital orbits much wider below than above, a little less wide than length of scape, polished, nearly impunctate; malar space nearly one-third as long as eye, somewhat shorter than length of scape, polished, nearly impunctate; mandibles weakly punctate. Head above antennae nearly flat, densely, rather finely punctate; area behind ocelli polished impunctate. Head viewed from above slightly broader than thorax, subquadrate, about one-third its width broader than long strongly convex in region of antennal fossea; viewed from the front with ocellar area not noticeably elevated, eyes almost parallel; ocelli arranged in a triangle, lateral ocelli twice as far apart as distance from inner margin of eye; with numerous golden setae, more abundant and longer below antennae. Antennae inserted close together and below middle of eyes, finely setaceous, flagellar segments of nearly equal thickness throughout; scape about twice as long as distance from its articulation to inner margin of eye, as long as pedicel and first flagellar segment together; pedicel about as long as broad, one-third the length of first flagellar segment; second flagellar segment longer than first, third and second segments of nearly equal length.

Alitrunk twice as long as broad, about one-third its length longer than high; with numerous golden setae. Pronotum not forming a collar visible from above on same plane as mesoscutum; humeral angles rounded and densely punctate. Mesoscutum with deep parapsidal and weak lateral grooves; finely punctate along cephalic margin and between parapsidal and lateral grooves, remainder of area polished and impunctate. Mesoscutellum with some punctures along cephalic margin adjacent to deep transverse suture, disk slightly convex, polished, almost impunctate. Metanotum narrow, coarsely and deeply reticulate. Propodeum cephalad of articulation of petiole coarsely punctate except for a small elevated, polished area at base of petiole. Propleura finely and densely punctate. Mesopleura with ventral portions and anterior swelling finely punctate; sulcus prominent, polished, impunctate; cephalo-dorsal angle setaceous, with several coarse impressions; caudo-dorsal angle with a crescentic row of punctures of moderate size limiting a small polished, elevated area dorsad of sulcus. Metapleura with a ventral coarsely punctate area, limited above by a narrow, polished impunctate area; this latter area with an adjacent dorsal area with longitudinal rows of elongate reticulations; sulcus very weakly developed. Truncature slightly convex, coarsely reticulate, with numerous pale setae. The articulation of

petiole far cephalad of metacoxal fossae, nearly dorsad of or vertical to metacoxal fossae, the truncature gradually sloping off from above to metacoxal fossae; metapleura somewhat triangular in outline. Metasternal processes slender, almost parallel throughout. Posterior tibia and posterior metatarsus with longitudinal rows of aciculae among the dense setae; posterior coxa above finely punctate. Inner posterior tibial spur longer than outer, a little less than one-half the length of posterior metatarsus; posterior metatarsus much longer than remaining tarsal segments together; tooth of claw stouter and longer than apical ray. Wings hyaline, front wings with three closed cells.

Petiole three times as long as distance from point of articulation to cephalic margin of propodeum, somewhat reticulate on lateral aspect, dorsum polished, with a few scattered fine punctures, very sparsely setaceous. Abdomen compressed, polished, with a few light-colored setae on dorsum.

One specimen, the holotype, collected January 28, 1920, at Teffé, Brazil.

**Brachygaster parishi** new species

Male. Length, 4 mm.

Head above antennae, occipital orbits, ventral portion of mesopleura, metapleura, propodeum below articulation of petiole, petiole, abdomen and hind legs, black. Face, mandibles, malar space, scape, pedicel, and anterior legs, fulvous with dark discolorations. Pronotum, mesoscutum, mesoscutellum, upper portion of mesopleura, metanotum, and propodeum above cephalad of articulation of petiole, ferruginous.

Head below antennae finely punctate; face with a small polished, elevated tubercle and separated from malar space by a weak, polished carina; occipital orbits much wider below than above, about as wide as length of scape, polished, with some minute punctures; lateral brims of antennal fossa strongly convex, polished and extending down on face; malar space two-fifths as long as eye, somewhat shorter than length of scape, polished, sparsely and finely punctate; mandibles polished, with some small punctures. Head above antennae almost flat, with numerous small punctures except on median line; area behind ocelli polished and impunctate. Head viewed from above slightly wider than thorax, transversely subquadrate, twice as broad as long, somewhat convex in region of antennal fossae; viewed from the front with ocellar area slightly elevated, eyes nearly parallel; ocelli arranged in triangle, lateral ocelli twice as far apart as distance from inner margin of eye; with light-colored setae, most abundant and longest below antennae. Antennae inserted rather close together and below middle of eyes, finely setaceous, flagellar segments of nearly equal thickness throughout; scape over twice as long as distance from its articulation to inner margin of eye, shorter than pedicel and first flagellar segment together; pedicel about as thick as long, nearly one-third as long as first flagellar segment; second flagellar segment much longer than first; third and second segments nearly equal in length.

Alitrunk scarcely longer than high, about one-third again as long as broad; with numerous pale setae. Pronotum forming a narrow collar distinctly visible from above; humeral angles somewhat angular and punctate. Mesoscutum with deep parapsidal and faint traces of lateral grooves; highly polished and impunctate except for a very few small punctures. Mesoscutellum with a few large puntures along cephalic margin adjacent to deep transverse suture, somewhat convex, highly polished, disk almost impunctate. Metanotum rather long, one-half as wide as first flagellar segment, coarsely sculptured. Propodeum cephalad of articulation of petiole convex, divided into two areas by a transverse row of large punctures; the anterior area polished and with some small punctures, the smaller posterior area highly polished and impunctate. Propleura narrow, concave, wrinkled. Mesopleura with dorsal portion, except for elongate depressed area in cephalo-dorsal angle, highly polished, impunctate; ventral portion and anterior swelling polished, minutely punctate; caudo-dorsal angle impunctate. Metapleura with ventral area, except along interpleural suture where it is impunctate, irregularly reticulate, limited above by a wide, polished, impunctate area; this latter area sharply limited above by large, irregular reticulations; sulcus weakly developed. Truncature almost flat, reticulate, with numerous pale setae. The articulation of petiole slightly cephalad of metacoxal fossae, the truncature rather steeply ascending to metacoxal fossae; metapleura somewhat subquadrate in outline. Metasternal processes distinctly cleft and slightly divergent at distal ends. Posterior tibia and posterior metatarsus with irregular rows of aciculae among the numerous setae; posterior coxa above with distal portion punctate. Inner posterior tibial spur much longer than outer, above one-half as long as posterior metatarsus; posterior metatarsus and remaining tarsal segments together of nearly equal length; tooth of claw longer and stouter than apical ray. Wings hyaline, front wings with three closed cells.

Petiole somewhat less than three times as long as distance from point of articulation to cephalic margin of propodeum, with a longitudinal carina on lateral aspect, polished and impunctate. Abdomen compressed, polished, somewhat triangular in outline.

In many respects related to *B. reticulifer* and *B. fraterna* Enderlein, described from Peru.

Two specimens from Iquitos, Peru.

Holotype collected on May 18, 1920. Paratopotype collected on the same date.

This species is named after Mr. H. S. Parish, who has collected so many new species of insects in South America.

**EVANIA** Fabricius

The genus *Evania*, in the sense of Kieffer, is represented in this collection by twelve specimens, separable into nine species. There are specimens from both Brazil and Peru.

*Key to Species of Evania here considered*

1. Malar space over one-half as long as eye; head smooth and only minutely punctate; thorax entirely black..... **appendigaster** Linnaeus
   Malar space less than one-half as long as eye; head with some coarse or conspicuous punctures; thorax not entirely black..... 2
2. Metanapleura with a conspicuous, polished, impunctate, oblique-longitudinal area..... 3
   Metanapleura without a conspicuous, polished, impunctate, oblique-longitudinal area..... 6
3. Dorsum of petiole with pronounced longitudinal carinae and rows of large irregular punctures..... **bella** new species
   Dorsum of petiole without pronounced longitudinal carinae, polished, at most with some small, scattered punctures..... 4
4. Mesopleural sulcus of average depression, species 5 mm. or over in length, head, thorax and petiole entirely light ferruginous..... 5
   Mesopleural sulcus noticeably depressed, species 3 mm. in length, petiole and ventral and caudal portions of thorax black... **delicata** new species
5. Mesopleura with a row of conspicuous reticulate or subquadrate punctures adjacent to interpleural suture..... **luculenta** new species
   Mesopleura without a row of conspicuous reticulate or subquadrate punctures adjacent to interpleural suture..... **clara** new species
6. Pronotum forming a collar visible from above on same plane as mesoscutum, and about one-half as wide as length of pedicel; petiole coarsely striate and punctate; posterior femur with numerous long, slender stiff setae. **barbata** new species
   Pronotum not forming a collar visible from above on same plane as mesoscutum; petiole polished and with but few small punctures; posterior femur with short hair-like setae..... 7
7. Head with a sharply outlined, polished, V-shaped carina ventrad of insertion of antennae; mesopleura ferruginous; petiole with distal half yellowish-white; flagellar segments one to three yellowish-white. **cerviculata** new species
   Head without a sharply outlined, polished, V-shaped carina ventrad of insertion of antennae; mesopleura black; petole and antennae black. **mystica** new species

**Evania appendigaster** Linnaeus

Four males, taken at Parintins, Flores and Obidos, Brazil, and Yurimaguas, Peru, on October 3, 1919, November 18, 1919, August 14, 1919 and April 26, 1920, respectively. The specimen from Peru is slightly smaller than those from Brazil.

**Evania bella** new species

Male. Length 5.5 mm.

Head, scape, pedicel, proximal half of flagellum, thorax, propodeum, petiole, fore and middle legs, hind coxa, trochanter, tarsus, proximal end of femur and

tibia, fulvous. Distal half of flagellum, distal two-thirds of hind tibia and femur and dentes of mandibles, brownish. Abdomen, exclusive of the petiole, black.

Head below antennae closely and moderately punctate, with a small tubercle on face; lateral margins of clypeus somewhat carinate, but not distinctly separating face from malar space; occipital orbits twice as wide below as above, in width about one-half the length of malar space, with numerous fine punctures; malar space about one-fourth as long as eye, about one-half the length of scape, with numerous fine punctures; mandibles weakly punctate. Head above antennae nearly flat, coarsely punctate; area behind ocelli somewhat punctate. Head viewed from above broader than thorax, transversely subquadrate, strongly convex in region of antennal fossae; viewed from the front with ocellar area not elevated, eyes slightly oblique below; ocelli arranged in a triangle, lateral ocelli less than twice as far apart as distance from inner margin of eye; with short golden setae, most numerous below antennae. Antennae finely setaceous, inserted close together and below middle of eyes, with a faint inter-antennal carina, flagellar segments of nearly equal thickness throughout; scape over twice as long as the distance from its articulation to inner margin of eye, slightly less than as long as pedicel and first flagellar segment together; pedicel about one-third as long as first flagellar segment; first, second and third flagellar segments nearly equal in length.

Alitrunk over a third longer than broad, one-seventh longer than high; with numerous pale setae, most abundant on ventral portions. Pronotum not forming a collar visible from above; humeral angles slightly angular. Mesoscutum with distinct parapsidal and lateral grooves, the parapsidal grooves much the deeper of the two; between parapsidal grooves with both large scattered punctures and small punctures; lateral lobes mainly with small punctures. Mesoscutellum with faint irregular, longitudinal striae, between which are many irregular, coarse punctures which often interrupt the striae. Metanotum narrow, well depressed, with large subquadrate reticulations. Propodeum cephalad of articulation of petiole coarsely punctate, limited laterally by deep reticulations of lateral aspect. Propleura concave, polished below and finely punctate above. Mesopleura with fore part of sulcus polished, impunctate; cephalo-dorsal angle with narrow, longitudinal depressions; anterior swelling with large shallow punctures, except for fine punctures adjacent to propleura; a row of large reticulations adjacent to interpleural suture. Ventral area of metapleura with large, shallow, scattered punctures between which are many fine punctures, with an adjacent polished, narrow, longitudinal dorsal area; this latter area limited above by irregular reticulations; sulcus weakly developed. Truncature nearly flat, finely reticulate, with numerous golden setae. The articulation of the petiole slightly cephalad of a line drawn vertical to or dorsad of metacoxal fossae; the metapleura somewhat subquadrate in outline. Metasternal processes with distal ends slightly divergent; median coxae close together and with distal portion of mesosternal processes divergent. Posterior tibia and posterior metatarsus with stout setae and a very few scattered aciculae on the outer surface of posterior tibia;

posterior coxa coarsely punctate above. Inner posterior tibial spur twice as long as the outer, two-thirds as long as posterior metatarsus; posterior metatarsus three-fourths as long as remaining tarsal segments together; tooth of claw much longer and stouter than apical ray. Wings hyaline, front wings with seven closed cells, subdiscoidal vein in the distal portion of front wing well chitinized and cubital vein but weakly so.

Petiole robust, nearly three times as long as distance from point of articulation to cephalic margin of propodeum, with pronounced longitudinal carinae and longitudinal rows of large irregular punctures on lateral and dorsal aspects. Abdomen compressed, polished, with some pale setae on dorsal portion.

Related in many ways to *E. ditoma* Kieffer, from Bolivia, but differs greatly in size, comparative length of malar space, petiole, etc. *E. pulcherrima* Szeplegeti, from Brazil and Peru, likewise has many points in common with this species.

One specimen, the holotype, collected April 26, 1920, at Yurimaguas, Peru.

**Evania delicata** new species

Male. Length, 3 mm.

Head, dentes of mandibles, flagellum, ventral portion of mesopleura, metapleura, propodeum, middle and hind legs, petiole and abdomen, black. Propleura, mesonotum, metanotum, tegulae and mesopleura above, ferruginous. Scape, proximal portion of mandibles and distal portion of fore legs, pale yellowish-brown. Tibial spurs yellow.

Head below antennae slightly convex, cephalic margin of clypeus almost impunctate, face finely punctate with a faint tubercle in middle; clypeus not separated from malar space by an elevated carina, but partially so separated by a short furrow extending from near precoila half way to the antennal fossae; occipital orbits as wide above as below, shiny, finely punctate; malar space about one-fifth as long as eye, longer than the pedicel, finely punctate; mandibles minutely punctate and setaceous. Head above antennae feebly convex, more strongly and densely punctured than below, punctures somewhat arranged in arcuate rows. Head viewed from above broader than thorax, transversely subquadrate, slightly convex in region of antennal fossae; viewed from the front with eyes almost parallel; ocelli arranged in a triangle, lateral ocelli twice as far apart as distance from inner margin of eye; with short whitish setae, most numerous below antennae. Antennae finely setaceous, inserted close together and below middle of eyes, with a faint interantennal carina, flagellar segments nearly of equal thickness throughout; scape three times as long as distance from its articulation to inner margin of eye, as long as pedicel and first flagellar segment together; pedicel about one-third as long as first flagellar segment; second flagellar segment longer than either the first or third segments, third flagellar segment longer than the first.

Alitrunk one-third longer than broad, as high as long; with numerous pale setae. Pronotum not forming a collar visible from above; humeral angles somewhat rounded. Mesoscutum with distinct parapsidal and very weakly

developed lateral grooves; cephalic portion with punctures of moderate and minute size intermixed, caudal portion somewhat polished and minutely punctate. Mesoscutellum on cephalic margin with a row of rather large punctures adjacent to transverse suture; disk somewhat polished with scattered punctures, lateral margins slightly reticulate. Metanotum narrow, well depressed, coarsely sculptured. Propodeum cephalad of articulation of petiole of very small area, roughly punctate, limited laterally by reticulations of lateral aspect. Propleura concave, punctate; humeral angles small. Mesopleura with sulcus noticeably impressed, dorsal portion of sulcus polished and impunctate; cephalo-dorsal angle weakly impressed; anterior swelling with large, shallow punctures; a row of punctures adjacent to interpleural suture. Metapleura with a large, shallow, punctate ventral area, limited dorsally by a narrow, polished impunctate area; this latter limited dorsally by an area of fine punctures and reticulations. Truncature concave, finely reticulate, reticulations in middle portion largest; with some short whitish setae. The articulation of petiole slightly cephalad of a line drawn vertical to or dorsad of metacoxal fossae. Metasternal processes slightly divergent at distal ends; median coxae about the length of first flagellar segment apart, mesosternal processes short and well separated. Posterior tibia and posterior metatarsus with numerous stout setae and a few irregular rows of aciculae; posterior coxa above rugose. Inner posterior tibial spur over twice as long as outer, two-thirds as long as posterior metatarsus; posterior metatarsus somewhat over one-half as long as remaining tarsal segments together; tooth of claw stouter but not longer than apical ray. Wings hyaline, front wings with seven closed cells, subdiscoidal and cubital veins indicated in distal portion of front wing by faint lines but not chitinized.

Petiole twice as long as distance from point of articulation to cephalic margin of propodeum, polished, but faintly punctate and setaceous. Abdomen compressed, polished, with a few pale setae on dorsal portion.

Because of the presence of distinct aciculae among the hair-like setae, this species will run closest to *E. dispersa* Schletterer, in Kieffer's key of 1912. *E. dispersa* Schletterer is said to have the longer metatibial spur not one-half the length of the posterior metatarsus, a statement which does not hold true for *E. delicata*. Also in *E. delicata* the posterior metatarsus is not as long as the remaining tarsal segments together.

One specimen, the holotype, collected April 13, 1920, at Yurimaguas, Peru.

**Evania luculenta** new species

Male. Length, 7.5 mm.

Head, antennae, thorax, propodeum, legs and petiole, light-ferruginous or rusty-yellow. Abdomen black.

Head below antennae slightly convex; with a distinct, elevated, polished, impunctate V-shaped carina ventrally limiting antennal basin; except on

polished cephalic margin of clypeus, with small punctures; face with a small polished tubercle; with a small furrow extending from near precoila dorsad to antennal fossae. Malar space about one-half as long as scape, about one-fourth as long as eye, with minute punctures; occipital orbits broad, much wider below than above, polished and with numerous small punctures; mandibles minutely punctured. Head above antennae nearly flat, with many punctures of moderate size, with interantennal carina extending towards median ocellus. Head viewed from above much broader than thorax, transversely subquadrate, conspicuously convex in region of antennal fossae; viewed from the front with eyes noticeably divergent, farther apart below antennae than above; ocelli arranged in a triangle, lateral ocelli somewhat farther apart than distance from inner margin of eye; with numerous short golden setae, more sparse and longer behind ocelli. Antennae inserted rather close together, slightly below middle of eyes; scape about four times as long as distance from its articulation to inner margin of eye, five times as long as pedicel, not as long as pedicel and first flagellar segment together; pedicel about one-fifth as long as first flagellar segment; flagellar segments of nearly equal thickness throughout, first and third segments nearly equal in length, second slightly longer than either.

Alitrunk about one-third longer than broad, somewhat longer than high; with numerous golden setae, particularly on ventral portions. Pronotum not forming a distinct collar when viewed from above; humeral angles angular and wrinkled. Mesoscutum with deep parapsidal grooves, lateral grooves but weakly indicated; median lobe with punctures of moderate and minute size intermixed, lateral lobes with minute punctures dominant. Mesoscutellum separated from mesoscutum by a deep transverse suture; with numerous punctures of moderate size somewhat arranged in longitudinal rows. Metanotum narrow, not deeply depressed, coarsely sculptured. Propodeum above cephalad of articulation of petiole with numerous, irregular, often confluent punctures of moderate size, sharply limited laterally by large reticulations of lateral aspect. Propleura concave, obliquely wrinkled below and with minute punctures above. Mesopleura with ventral portion, anterior swelling and caudal half of sulcus with numerous shallow, rounded punctures of moderate and minute size intermixed; cephalic half of sulcus and area adjacent to propleura highly polished and impunctate, limited above by wrinkled impressed cephalo-dorsal angle and a strip of large subquadrate reticulations and many minute punctures adjacent to interpleural suture. Metapleura with its cephalo-dorsal angle forming a somewhat polished finely punctate triangular area; sulcus feebly impressed, with small polished impunctate area on cephalic portion extending half way from finely punctate triangular area to metacoxal fossa; ventral portion and caudal half of sulcus with large, shallow, rounded punctures, dorsad of sulcus with large irregular reticulations. Truncature nearly flat, reticulate setaceous. The articulation of petiole cephalad of a line drawn vertical to metacoxal fossae. Median coxae rather close together and about one-half length of petiole removed from posterior coxae, mesosternal processes more divergent at distal ends than metasternal processes, metasternal processes long and divergent at distal ends. Posterior

coxa above irregularly transversely wrinkled; posterior tibia and posterior metatarsus with some aciculae among the numerous smaller stout setae. Inner posterior tibial spur over twice as long as outer, three-fifths as long as posterior metatarsus; posterior metatarsus three-fourths as long as remaining tarsal segments together, tooth of claw much stouter and slightly longer than apical ray. Wings hyaline, front wings with seven closed cells, subdiscoidal vein well chitinized in distal portion of front wing, cubital vein but weakly so.

Petiole about twice as long as distance from point of articulation to cephalic margin of propodeum; polished, with some small punctures on dorsal and lateral aspects. Abdomen compressed, polished, with a few pale setae on dorsum of segments.

The holotypic male was collected at Teffé, Brazil, on January 20, 1920. A second male, a paratype, is from Iquitos, Peru, and was collected March 4, 1920.

The specimen from Peru differs slightly from the holotype in that the interantennal carina does not extend so far dorsad, the posterior coxa is less wrinkled, and the tooth of the claw is much longer than the apical ray. As the differences involved are simply differences of degree, I have considered the specimens as belonging to the same species.

**Evania clara** new species

Male. Length, 6.5 mm.

Head, proximal portion of mandibles, scape, pedicel, proximal flagellar segments, thorax, propodeum, anterior legs and proximal portion of hind legs, and petiole, ferruginous. Dentes of mandibles, distal portion of flagellum, and distal portion of hind legs, fuscous. Abdomen black.

Head below antennae slightly convex, polished, minutely punctate, with a small tubercle on face; clypeus separated from malar space by a furrow extending from near precoila dorsad, and an adjacent slight elevation; occipital orbits broad, somewhat wider below than above, polished, faintly punctate; malar space about three-fifths as long as eye; antennal basin limited below by a V-shaped polished ridge; pedicel polished, minutely punctate; mandibles sparsely, finely punctate and setaceous. Head above antennae slightly convex; with large, irregular, often confluent punctures. Head viewed from above broader than thorax, transversely subquadrate, projecting in region of antennal fossae; viewed from front with eyes somewhat convergent below; ocelli arranged in a triangle, the lateral ocelli but slightly farther apart than distance from inner margin of eye; with numerous golden setae, most abundant below antennae. Antennae finely setaceous, inserted closer together than distant from inner margin of eye and below middle of eyes, with a feeble interantennal carina, flagellar segments gradually decreasing in thickness from proximal to distal end; scape nearly four times as long as distance from its articulation to inner margin of eye, four times the

length of pedicel and nearly equal to length of pedicel and first flagellar segment combined; second flagellar segment slightly longer than the first.

Alitrunk nearly one-third longer than broad, somewhat longer than high; with numerous golden setae, more dense and abundant on ventral portions. Pronotum not forming a collar visible from above; humeral angles slightly angular. Mesoscutum with deep parapsidal and faint lateral grooves; polished and minutely punctate, except for a few large shallow punctures on cephalic portion and adjacent to inner margin of parapsidal grooves. Mesoscutellum separated from mesoscutum by a narrow transverse suture; disk polished, impunctate except for a few large scattered punctures; lateral margins with large and small punctures intermixed. Metanotum narrow, wrinkled, median portion not well depressed. Propodeum cephalad of articulation of petiole minutely punctate, limited laterally by reticulations of lateral aspect. Propleura obliquely concave; wrinkled and setaceous on ventral portion, dorsal portion finely punctate. Mesopleura with dorsal portion of sulcus and cephalic margin above polished, impunctate; anterior swelling densely and minutely punctate; with a narrow, minutely punctate, setaceous strip adjacent to interpleural suture extending to cephalo-dorsal angle; cephalo-dorsal angle with several short longitudinal carinae and small punctures between carinae. Metapleura with a ventral area of fine punctures below and large, shallow almost reticulate punctures above; this area limited dorsally by a short narrow polished impunctate area, in turn limited on dorsum by irregular reticulations of propodeum. Truncature almost flat, irregularly setaceous. The articulation of petiole nearly vertical to or dorsad of mesocoxal fossae. Mesocoxal fossae and metacoxal fossae placed close together, mesosternal processes nearly similar to the metasternal processes, which are rather broad, divergent at distal ends and somewhat directed ventrad. Posterior tibia and posterior metatarsus with numerous stout setae, and a few scattered aciculae; posterior coxa above polished, minutely punctate and setaceous. Inner posterior tibial spur over twice as long as outer, about two-thirds as long as posterior metatarsus; posterior metatarsus about four-fifths of length of remaining tarsal segments together; tooth of claw much longer and stouter than apical ray. Wings hyaline, front wings with seven closed cells, subdiscoidal vein in distal portion of front wing well chitinized and cubital vein but weakly so.

Petiole over twice as long as distance from point of articulation to cephalic margin of propodeum, polished, with but few punctures and setae. Abdomen compressed, polished, with numerous pale hair-like setae on dorsum of all segments and lateral margins of apical segments.

One specimen, the holotype, collected May 4, 1920, at Iquitos, Peru.

**Evania barbata** new species

Male. Length, 4.5 mm.

Head, ventral half of mesopleura, metapleura, propodeum, petiole, abdomen, posterior coxae and hind legs, black. Prothorax, dorsal half of mesopleura, mesoscutum, mesoscutellum and metanotum, ferruginous. Antennae, proximal portion of mandibles and anterior legs, testaceous.

Head below antennae slightly convex, cephalic margin of clypeus impunctate and polished, remainder of area moderately punctate, the punctures ventrad somewhat arranged in oblique-longitudinal rows; a small tubercle on face, connected with antennal basin by a slightly swollen ridge; antennal basin limited below by a slightly swollen punctate ridge, area between antennae faintly elevated in middle and polished; malar space not distinctly separated from face by a carina, less than one-fourth as long as eye, nearly twice as long as pedicel, finely wrinkled; occipital orbits broad, wider below than above, finely punctate and somewhat finely, longitudinally wrinkled; mandibles with a few scattered, moderately-sized punctures on proximal half, with numerous pale setae. Head above antennae nearly flat, moderately and densely punctate, a small longitudinal carina extending a short distance below median ocellus. Head viewed from above scarcely broader than thorax, transversely subquadrate, slightly convex in region of antennal fossae; viewed from the front with eyes almost parallel; ocelli arranged in a triangle, lateral ocelli somewhat farther apart than distance from inner margin of eye; with numerous whitish-yellow setae occurring from cephalic margin of clypeus to half way between articulation of antennae and median ocellus, those about and dorsad of ocelli sparse and more erect. Antennae inserted somewhat farther apart than distance from inner margin of eye, far below middle of eyes; scape about four times as long as distance from its articulation to inner margin of eye, four times as long as pedicel, almost equal to length of the pedicel and first flagellar segments together; pedicel about one-fourth the length of first flagellar segment; flagellar segments of nearly equal thickness throughout, first flagellar segment longer than either the second or third.

Alitrunk one-third longer than broad, somewhat longer than high; with numerous pale setae, unusually long on ventral portions. Pronotum forming a distinct collar when viewed from above, cephalic margin strongly carinate; humeral angles angular. Mesoscutum with deep parapsidal grooves, slightly interrupted anteriorly by weak transverse ridges; lateral grooves distinct, but weakly impressed; cephalic portion with a few large and numerous minute punctures, besides some weak transverse wrinkles; caudal portion polished, minutely punctate. Mesoscutellum separated from mesoscutum by a narrow transverse suture and a few small adjacent punctures; disk polished, with several large scattered punctures; lateral margins with several longitudinal rows of coarse, often confluent punctures. Metanotum narrow, deeply impressed, with a row of large subquadrate punctures. Propodeum above cephalad of articulation of petiole with irregular punctures of moderate size, sharply and abruptly limited by reticulations of lateral aspect. Propleura concave, obliquely longitudinally wrinkled, minutely punctate. Mesopleura with ventral portion of anterior swelling minutely punctate, dorsal portion coarsely punctate; dorso-cephalic portion of sulcus and area adjacent to propleura polished, impunctate; polished area bordered above by a narrow band of small punctures adjacent to interpleural suture and impressed, wrinkled cephalo-dorsal angle. Metapleura with its cephalo-dorsal angle forming a finely punctate triangular area; sulcus shallowly impressed, without a

polished, impunctate oblique area; ventrad of sulcus with rounded reticulations of moderate size, dorsad of sulcus with reticulations larger and more irregular than those below. Truncature slightly concave, reticulate, setaceous. The articulation of petiole somewhat cephalad of a line drawn vertical to metacoxal fossae. Median coxae widely separated and far removed from posterior coxae, mesosternal processes short, widely separated and slightly divergent; posterior coxae placed much closer together, metasternal process broad, deeply cleft, outer margins slightly divergent. Posterior coxa above moderately wrinkled and punctate, with numerous conspicuous, long, pale setae; posterior trochanter and femur with many short pale setae and stiff, erect, bristle-like setae intermixed; posterior tibia and posterior metatarsus with dense stout setae. Inner posterior tibial spur twice as long as outer, half as long as posterior metatarsus; posterior metatarsus much shorter than remaining tarsal segments together; tooth of claw weakly developed. Wings hyaline, front wings with seven closed cells, subdiscoidal and cubital vein in distal portion of front wing not chitinized and but faintly indicated.

Petiole over twice as long as distance from point of articulation to cephalic margin of propodeum; coarsely, irregularly striate and punctate on dorsum, obliquely-longitudinally striate on lateral aspect; conspicuously setaceous at proximal end. Abdomen compressed, polished, with numerous pale setae on dorsum.

One specimen, the holotype, collected January 2, 1920, at Teffé, Brazil.

**Evania cerviculata** new species

Female. Length, 6.5 mm.

Head, scape, pedicel, flagellum beyond second segment, metapleura, propodeum, proximal two-thirds of posterior coxa, proximal half of petiole, abdomen, black. Prothorax, mesothorax, metanotum, ferruginous. First and second flagellar segments, distal ends of median and posterior coxa and proximal half of median and posterior trochanter, and distal half of petiole, whitish yellow. Fore legs light brownish-yellow, middle and hind legs darker.

Head below antennae slightly convex; with a distinct, sharply elevated, polished, impunctate, V-shaped carina ventrally limiting the antennal basin, the point of V slightly extending ventrad on face; with numerous, oblong punctures arranged in longitudinal rows; with a small furrow extending from near precoila dorsad half way to antennae. Malar space about one-third the length of eye, with numerous small punctures; occipital orbits very broad, wider below than above, with sparse punctures of moderate size and numerous minute punctures; mandibles finely punctate. Head above antennae with a sharp interantennal carina extending nearly to the median ocellus; lateral brim of antennal fossa extending as a carina half way to ocelli, and adjacent to outer edge of this carina, a longitudinal row of coarse punctures extending to ocelli; intervals between carinae slightly concave, densely, finely punctate; area behind ocelli rather coarsely punctate. Head viewed from above broader than the thorax, transversely subquadrate, slightly con-

vex in region of antennal fossae; viewed from the front with eyes slightly oblique; ocelli arranged in a triangle, lateral ocelli less than twice as far apart as distance from inner margin of eye; dense, short, white setae extending from cephalic margin of clypeus to half way between antennal fossae and ocelli; setae about ocelli scattered, longer than those below, pale-brownish. Antennae inserted about one-half length of petiole apart, far below middle of eyes; scape four times as long as distance from its articulation to inner margin of eye, much longer than pedicel and first flagellar segment together; pedicel less than one-half as long as first flagellar segment; flagellar segments slightly enlarged distad of second segment, second segment much longer than first segment, first segment longer than third.

Alitrunk nearly twice as long as broad, nearly one-third again longer than high; with numerous short, pale setae, on truncature particularly dense and whitish. Pronotum not forming a distinct collar on same plane as mesoscutum when veiwed from above, but with neck strongly produced forward; humeral angles rounded. Mesoscutum with deep parapsidal grooves, lateral grooves indicated by polished lines; with scattered punctures of moderate size and numerous minute punctures intermixed. Mesoscutellum separated from mesoscutum by a transverse suture, punctured about like mesoscutum. Metanotum narrow in center, widened somewhat laterally, coarsely punctured. Propodeum above cephalad of articulation of petiole coarsely punctate, punctures at base of petiole often confluent. Propleura wrinkled below, above punctate. Mesopleura with ventral portion and anterior swelling coarsely punctate; caudal half of sulcus wrinkled, a small polished spot in the middle, cephalic portion and area adjacent to propleura densely and minutely punctate. Metapleura with cephalo-dorsal angle finely punctate; ventral half with large, coarse, shallow punctures, limited above by irregular reticulations. Truncature nearly flat, with irregularly subquadrate reticulations and dense whitish setae. The articulation of petiole cephalad of a line vertical to metacoxal fossae, the metapleura somewhat triangular in outline. Metasternal processes slightly divergent at distal ends. Posterior coxa reticulate above; posterior tibia and posterior metatarsus with some aciculae arranged in irregular longitudinal rows among the numerous smaller setae. Inner posterior tibial spur much longer than outer, one-half length of posterior metatarsus; posterior metatarsus nearly as long as remaining tarsal segments together; tooth of claw much longer and stouter than apical ray. Wings hyaline, front wings with seven closed cells, subdiscoidal and cubital vein in distal portion of front wing not citinized and but faintly indicated.

Petiole twice as long as distance from point of articulation to cephalic margin of propodeum, polished, with but few scattered, minute punctures. Abdomen compressed, polished, triangular in outline; first four segments beyond petiole bare, following two segments with dorsum and upper half of lateral aspect with dense whitish setae, apical segment with sparse golden setae.

One specimen, the holotype, collected on September 11, 1919, at Obidos, Brazil.

**Evania mystica** new species

Male. Length, 4.5 mm.

Head, mesopleura, metathorax, propodeum, petiole, abdomen, middle and hind legs, black. Pronotum and mesonotum, ferruginous. Antennae and fore legs fuscous.

Head below antennae slightly convex; with punctures of moderate size, except on polished cephalic margin of clypeus; a small tubercle on face; with a small furrow extending from near precoila about to articulation of antennae. Malar space shorter than scape, about one-fourth as long as eye, with numerous punctures of moderate size; occipital orbits broad, somewhat wider below than above, portion adjacent to outer margin of eye with punctures of moderate size, remaining portion polished; mandibles with proximal half finely punctate. Head above antennae and behind ocelli with punctures of moderate size. Head viewed from above much broader than thorax, transversely subquadrate, convex in region of antennal fossae; viewed from the front with eyes nearly parallel; ocelli arranged in a triangle, lateral ocelli less than twice as far apart as distance from inner margin of eye; with numerous golden setae, most abundant below antennae. Antennae inserted rather close together, below the middle of the eyes; scape over twice as long as distance from its articulation to inner margin of eye, over three times as long as pedicel, not as long as pedicel and first flagellar segment together; pedicel about one-third as long as first flagellar segment; flagellar segments of nearly equal thickness throughout, first and second segments nearly equal in length, third slightly longer than either.

Alitrunk nearly twice as long as broad, about one-third again longer than high; with dense whitish setae on ventral parts and pleura, dorsum with sparse golden setae. Pronotum not forming a distinct collar visible from above; humeral angles rounded, wrinkled. Mesoscutum with deep parapsidal grooves, lateral grooves weakly developed; area between parapsidal grooves with scattered punctures of moderate size and minute punctures intermixed; lateral lobes minutely punctate. Mesoscutellum separated from mesoscutum by a transverse suture and an adjacent row of small punctures, with many punctures of moderate size. Metanotum narrow, well depressed, reticulate. Propodeum above cephalad of articulation of petiole reticulate, except for a small, elevated, polished, impunctate area at base of petiole. Propleura concave, wrinkled. Mesopleura with ventral portion, anterior swelling and caudal portion of sulcus with many shallow, rounded punctures of moderate size; cephalic portion of sulcus polished and impunctate, except for a small strip of minute punctures adjacent to propleura; cephalo-dorsal angle impressed. Metapleura with cephalo-dorsal angle finely punctate and setaceous; ventral half with small reticulations, limited above by a very narrow strip of small punctures; this latter area limited above by irregular reticulations. Truncature slightly concave, with irregular subquadrate reticulations and dense whitish setae. The articulation of the petiole far cephalad of a line vertical to metacoxal fossae. Metasternal processes slightly divergent at distal ends. Posterior coxa rugose above; posterior tibia with aciculae arranged in irregular longitudinal rows among the numerous smaller

setae, posterior metatarsus with a few aciculae on outer surface. Inner posterior tibial spur twice as long as outer, one-half as long as posterior metatarsus; posterior metatarsus not as long as remaining tarsal segments together; tooth of claw longer and stouter than apical ray. Wings hyaline, front wings with seven closed cells, subdiscoidal and cubital vein in distal portion of front wing not chitinized and but faintly indicated.

Petiole about twice as long as distance from point of articulation to cephalic margin of propodeum, polished, with some minute punctures and light-colored setae. Abdomen compressed, polished, first four segments beyond petiole with whitish setae on dorsal portion, remaining segments with short setae very abundant both on lateral and dorsal portions.

One specimen, the holotype, collected July 15, 1919, at Igarapé-Assú, Brazil.

# NOTES ON CERTAIN SPECIES OF MELANOSTOMA (DIPTERA; SYRPHIDAE)[1]

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The following paper is an attempt to deal with the commoner North American species of *Melanostoma* wherein the facial ground color is obscured by whitish pollen, more or less in ripple-like formation, and the abdomen is banded with metallic fasciae.

The writer has placed Bigot's *M. rostratum* as a variety of the common *obscurum* Say of the Eastern States. From the description *M. pictipes* Bigot is not with certainty applicable to any species known to him.

Three of the species, *stegnum* Say, *obscurum* Say var. *rostratum* and *chaetopoda* new species were bred from the ovum, the larvae feeding on aphids and transforming much in the same manner as contemporaneous larvae of species known to be normally aphidophagous (*Eupeodes volucris* Osten Sacken, *Allograpta obliqua* Say, etc.). Whether or not *Melanostoma* larvae are normally aphidophagous appears still in doubt; it is certain that field collections of larvae associated with aphids are very rare, when the abundance of the adult flies is taken into consideration.

In the laboratory, however, the larvae are easily reared on an aphid diet, while gravid females, collected in the field, deposit ova in cages about as readily as species of *Syrphus, Eupeodes* or *Allograpta*.

Acknowledgment is due to Mr. C. Howard Curran, Vineland, Ontario, for the type material of *Melanostoma ontario* new species for other material used in the preparation of this paper, and also for helpful suggestions.

**Melanostoma chaetopoda** new species (Text-fig. A.)

Male. Antennae oval, third joint twice as long as wide; brownish black, lighter below; arista black. Vertex and frontal triangle shining bluish-black; pile black, of moderate length. Face with whitish punctate pollen, a median shining black stripe not reaching the antennae, facial pile white; breadth

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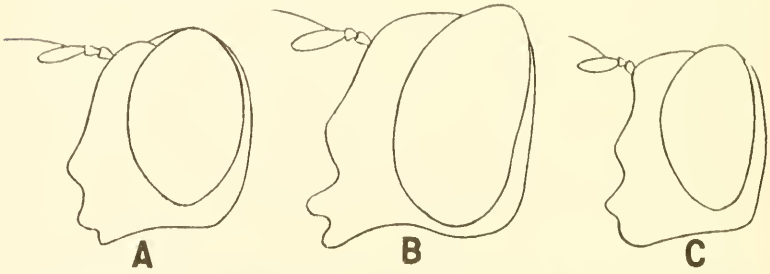
of the face between the eyes below greater than the distance between the antennae and the mouth edge. Cheeks shining black, gray pollinose, white pilose; profile of face almost perpendicular below antennae, receding below the obtuse facial knob. Eyes red, bare. Occiput silvery pollinose, pile white beneath, dark above.

Thorax and scutellum shining bluish-black, pile light gray; at apex of scutellum a few longer blackish hairs. Wings exceeding abdomen in length, hyaline, stigma light amber. Halteres dull grayish white. Tegulae dull white, fringe fulvous. Legs black, knees yellow, front and middle tibiae and tarsi testaceous; front tibiae with a row of six long and rather stout black bristles, middle tibiae with four similar, but slenderer bristles; pile elsewhere on legs mostly whitish; pile on the sides of the thorax white.

First segment of the abdomen shining bronze. Second segment opaque black, on each side at the margin an elongate shining spot. Third segment opaque black, two narrowly interrupted rhomboidal shining bronze spots, extending from the anterior margins two-thirds of the length of the segment. Fourth segment similar to the preceding, but the bronze spots do not extend beyond the middle of the segment and the posterior border is narrowly shining bronze. Fifth segment and venter shining bronze. Hypopygium shining black. Abdominal pile white.

Length, 7 to 8.5 mm.




Text-figures. A.—*Melanostoma chactopoda* new species; profile of head of female (outline). B—*Melanostoma obscurum* var. *rostratum* Bigot; profile of head of male (outline). C—*Melanostoma ontario* new species; profile of head of male (outline).

This species may be recognized by the broad face which recedes below and is almost perpendicular in profile, by the black facial stripe and by the thickened bristles of the front tibiae.

Described from six specimens collected in the vicinity of Alhambra, California, and from two individuals reared from the egg at Alhambra, 1919 and 1920.

Female. Antennae oval, brownish black, distal joint at base below yellowish red. Vertex shining black with black pile. Face with whitish punctate pollen below antennae, a shining black median stripe not reaching the antennae. Cheeks shining black, grayish pollinose, white pilose. In profile the face

is slightly concave below the antennae, the facial knob protrudes beyond the antennal tubercle, below the knob the face recedes. Eyes bare. Occiput silvery pollinose, white pilose.

Thorax and scutellum shining bluish-black, pile white. Wings exceeding the abdomen, hyaline, stigma light amber. Halteres pale yellow. Tegulae white. Legs testaceous, femora except apices black; hind tibiae with an obscure dark brown ring at apical third; pile of legs whitish.

First abdominal segment shining metallic green. Second segment shining metallic green, posterior border and a median emarginated projection opaque black. Third segment similar to preceding, except that the shining emargination is narrower and reaches deeply into the opaque portion. Fourth segment shining metallic green, with two oblique opaque black spots which touch the margin at the posterior angles of the segment, and do not quite reach the middle of the segment at their anterior ends. Fifth segment shining metallic green. The opaque bands of the second and third segments narrowly reach the lateral margins and in the middle reach beyond the middle of the segment. Pile of abdomen white.

Length, 6.5 to 8 mm.

Described from ten specimens collected in the vicinity of Alhambra, California, and from one specimen reared from the egg at Alhambra, 1920.

Holotype (male) and allotype (female) in the U. S. National Museum.

The female may be recognized from that of other species treated in this paper by the greenish abdominal bands and punctate facial pollen; from *M. stegnum* by the longer facial stripe.

In general this species approaches *M. stegnum* more nearly than any of the others. Both have punctate pollen on the face and the black hairs of the fore tibiae are thickened. In *stegnum* the shining abdominal spots are greenish or greenish-gray in both sexes, in *chactopoda* those of the male are distinctly bronze. That the two sexes above described under this name belong together has been proved by breeding experiments.

**Melanostoma ontario** new species (Text-fig. C.)

Male. Antennae brownish black; third joint oval, twice as long as wide, yellowish at the base below; arista bare, black. Vertex black, black pilose. Frontal triangle black, obscurely shining; pile black, of moderate length. Face whitish pollinose, in obscure ripple-like formation; in the middle a bare shining bluish stripe not reaching base of antennae. Profile below antennae shallowly excavated, the facial tubercle protruding slightly beyond the antennal; below this concave, the epistoma protruding equally with the facial tubercle; thus the face is perpendicular in profile. Cheeks shining bluish with scant white pollen, white pilose. Eyes red, bare. Occiput silvery pollinose; pile below white, above fuscous.

Thorax and scutellum shining bluish-gray, pile fulvous; scutellum with a border of longer fuscous hairs; pleura white pilose. Halteres gray. Tegulae white, fringe fulvous. Wings exceeding the body in length, hyaline, stigma dilute yellow. Legs testaceous, femora black except at apices; front and middle tibiae with a narrow fuscous ring, hind tibiae with a broader black ring; tarsi except the basal joint of four anterior legs fuscous; all the tibiae with a row of long slender black hairs, pile on legs elsewhere mostly white.

First abdominal segment shining bronze black. Second segment opaque black, on each side with an elongate shining greenish-gray spot; this spot is produced along the anterior borders and again at the middle of the segment, and is narrowly separated from the posterior border. Third segment opaque black, with two triangular shining greenish-gray spots extending along the anterior border and reaching along the sides two-thirds the length of the segment; an indefinite narrow shining stripe runs down the middle of the segment. Fourth segment shining greenish-gray; on the posterior half two slightly oblique opaque black spots, narrowly separated in the middle and narrowly cut off from the posterior border of the segment; these spots touch the lateral margin just anterior to the posterior angles. Fifth segment shining greenish-gray. Hypopygium shining black, pile of abdomen white, on opaque portions black and white intermixed.

Length, 7.1 mm.

Described from two individuals collected in Ontario, Canada, (C. H. Curran), in 1913.

Female. Antennae brownish-black; third joint yellow below, oval, twice as long as wide; arista fuscous. Vertex shining black, pile black. Face with obscure ripple-like whitish pollen, which extends upward on the side to the vertex; in the middle a black shining stripe not reaching the antennae; pile of the face white. Cheeks shining black, with scant grayish-white pollen, white pilose. In profile the face is shallowly excavated below the antennae, the facial tubercle slightly protruding beyond the antennal tubercle; below the facial tubercle the face recedes. Eyes bare. Occiput white pollinose, white pilose.

Thorax and scutellum shining bluish-gray, pile light yellow; on the border of the scutellum two longer pale hairs. Wings exceeding the abdomen in length, stigma dilute yellow. Halteres dull yellow. Tegulae white, fringe fulvous. Legs testaceous, basal half of front and middle femora, basal two-thirds of hind femora, black; hind tibiae fuscous; hind tarsus and last two joints of four anterior tarsi black.

First abdominal segment shining black. Second segment opaque black with two triangular shining bronze spots, broadly separated, reaching behind almost to the posterior angle of the segment. Third segment opaque black, with an anterior shining bronze fascia, which is produced laterally almost to the posterior angle of the segment. Fourth segment shining bluish gray, in front with two triangular bronze spots; on the posterior half of the segment two slightly oblique opaque black spots narrowly separated and joining the

margin of the segment briefly at the posterior angles. Fifth segment shining gray; on the second and third segments there is a narrow shining median stripe. Pile white, on opaque portions black and white intermixed.

Length, 6.75 mm.

One specimen, Canada which apparently belongs with the two males.

Holotype (male) and allotype (female) in the U. S. National Museum.

This species differs from *M. obscurum* and *M. obscurum* var. *rostratum* in the fact that the head is not produced below beak-like; from *M. chactopoda* in the abdominal spots of the female being distinctly bronze, and not greenish, and in the pollen of the face of both sexes being non-punctate.

**Melanostoma obscurum** Say, variety **rostratum** Bigot (Text-fig. B.)

Male. Antennae brownish-black; joint three oval, twice as long as broad, yellow below at the base, sometimes the whole underside yellowish; arista black, bare. Vertical triangle bluish-black, black pilose. Frontal triangle bluish-black, obscurely shining, black pilose. Face grayish pollinose in indistinct ripple-like formation, a median rather narrow shining bluish-black stripe not reaching the antennae; facial pile black above, white below. Cheeks shining black with scant whitish pollen and white pile; facial tubercle protruding considerably beyond antennal tubercle, the epistoma protruding beyond the facial tubercle; giving the face in profile a rostrate appearance; below the antennae gently concave. Eyes red, bare, contiguous, ten facets. Occiput white pollinose, pile white below, fuscous above.

Thorax and scutellum bluish-gray, shining; pile fulvous, scutellar pile long, black and fulvous mixed; on the humeri a tuft of black hairs. Wings equal to or exceeding the body length, hyaline. Halteres dull gray. Tegulae white, fringe fulvous. Legs black, apical third of four anterior femora testaceous; hind knees yellow; anterior tibiae except a broad ring near the apex, whole of middle tibiae, base and apex of hind tibiae, basal joints of all tarsi, testaceous; hind metatarsi slightly incrassate; pile of legs mostly light; all tibiae with a row of about eight long slender black hairs.

First abdominal segment shining bluish-gray. Second segment opaque black along the side with a shining silvery-gray spot, which is produced along the anterior border, again at the middle of the segment, and reaches along the sides three-quarters the length of the segment. Third segment opaque black, with two shining bronze trigonal spots; these spots reach on the lateral margins two-thirds the length of the segment; second and third segments also with a narrow median shining stripe. Fourth segment shining bronze, on its posterior half with two narrowly separated slightly oblique opaque black spots, which reach the margin of the segment just before the posterior angle. Fifth segment shining bronze. Hypopygium shining black. Venter shining purplish-black. Pile of abdomen white, on the opaque areas short black and white intermixed. Sides of the abdomen nearly parallel.

Length, 6.5 to 9 mm.

Described from twenty individuals from Alhambra and Berkeley, California, 1919 and 1920.

Female. Antennae brownish-black; third joint oval, twice as long as broad, yellowish red below; arista dark brown, bare. Vertex shining bluish-black, pile black, above the antennae a band of gray pollen. Face on the sides below grayish pollinose in obscure ripple-like formation, a median shining bare stripe not reaching the antennae. Cheeks shining gray with scant whitish pollen and white pile; pile of the face white below, and black above, the antennae. In profile the face is rostrate, the epistoma projecting beyond the facial tubercle and this in turn projects beyond the antennal tubercle.

Thorax and scutellum shining bluish-gray, pile white, a few longer black hairs on the margin of the scutellum. Wings project slightly beyond the body, hyaline; stigma light amber. Halteres gray. Tegulae white, fringe fulvous. Legs black, apical half of the four anterior femora reddish-brown, hind knees fuscous, anterior and middle tibiae reddish-brown, basal joints of the four anterior tarsi yellowish brown; base and apex of hind tibiae fuscous; pile of the legs mostly white.

First abdominal segment shining grayish-black. Second segment on the sides and anterior margins shining grayish-black, posterior margins opaque black; in the middle of the segments two bronze spots. Third segment opaque black, with two shining orange colored spots narrowly separated from the anterior border. Fourth segment shining grayish with two similar orange spots and with an interrupted opaque black band on the posterior half. Fifth segment shining greenish-gray, the pile of the abdomen white, on the opaque areas black and white intermixed. Abdomen narrowly oval, widest at the apex of the second segment.

Length, 6 to 8.5 mm.

Described from twelve individuals collected and bred at Alhambra, California, 1919 and 1920.

This appears to be the form described by Bigot as *M. rostratum*[2]; it differs from typical *obscurum* in the facial stripe being narrower, the thorax more of a bluish-black instead of greenish-black, the scutellar hairs longer and more black on the disc as well as at the edge.

This species is very abundant in Southern California in Spring.

**Melanostoma trichopus** Thomson

In the National Museum collection are several specimens from Alaska which have been identified as this species. In the facial characters, including rostrate epistoma, they closely resemble *M. obscurum* Say and the variety *rostratum* Bigot. The abdomen of the male is narrower than in these two flies, while

[2] Bigot, Ann. Soc. Ent. France, 1884, p. 80.

the shining spots are distinctly gray and not bronze. In the female these spots are orange, and the abdomen is more oval. Thomson described his species from California.

*Key to the Species of Melanostoma described or mentioned above*

I

Pollen of face in obscure ripples, impunctate ..... 3
Pollen of face punctate ..... 2
2. Face with a shining black stripe, vertical ..... **chaetopoda** new species
Face with but the tubercle shining ..... **stegnum** Say
3. Profile of face almost perpendicular, not obviously rostrate.
**ontario** new species
Profile of face rostrate, the epistoma projecting considerably beyond the facial tubercle ..... 4
4. Thorax shining greenish-black, the facial stripe broad ..... **obscurum** Say
Thorax shining bluish-black or bluish-gray, facial stripe narrow.
**obscurum** Say, var. **rostratum** Bigot

II

Facial tubercle alone shining ..... **stegnum** Say
Vertical shining stripe on the face, but not reaching the antennae ..... 2
2. Facial profile rostrate, the epistoma projecting considerably beyond the facial tubercle of knob ..... 3
Facial profile perpendicular, the epistoma not projecting beyond the facial knob ..... 4
3. Thorax greenish-black, facial stripe broad ..... **obscurum** Say
Thorax bluish-black or bluish-gray, facial stripe narrow.
**obscurum** Say, var. **rostratum** Bigot
4. Facial pollen punctate ..... **chaetopoda** new species
Facial pollen in obscure ripple-like formations and impunctate.
**ontario** new species

## Biological Notes

**Melanostoma stegnum** Say (Pl. I, fig. D.)

A gravid female was collected in the field at Alhambra, California, on March 11, 1920, and transferred to a chimney cage enclosing a young broad bean plant infested with *Aphis rumicis* Linnaeus. The fly was fed with sugar water and died March 20, after having deposited ninety-seven ova on the foliage. These ova in many cases were ranked side by side or end to end, but a few were laid singly. The ovum is cylindrical, elongate, rather sharply tapering at each, more so at the non-micropylar end; white, not chalky; chorion sculptured with regular hexagonal markings, small and not elevated; size of ovum .88 mm. × .32 mm.

The majority of the eggs laid in captivity were fertile and eighty-eight larvae issued after an average incubation period of seven and one-half days.

The newly-hatched larva is pale yellowish-white and unarmed. Just previous to the first molt the general appearance is grayish, the integument being very transparent and smooth. The shape of the larva is cylindrical. Following the second molt the color is a yellowish-brown with a darker dorsal line, the internal tissues plainly visible through the integment. Each body segment bears a transverse row of short pale bristles. The full grown larva is 8.5 mm. in length and 2.3 mm. in maximum width; viscera plainly visible through the hyaline integument giving a general color of grayish-brown. Shape sub-cylindrical, slightly flattened dorsally, sides shallowly wrinkled and carinate, each segment armed with short pale spines; anterior spiracles light brown; posterior respiratory tubes brown, fused for their entire length, the combined width twice the individual length, each tube sub-cylindrical.

In the insectary ten larvae were raised on a diet of aphids, the species consumed being *Myzus rosarum* Walker, *Rhopalosiphum nervatum* Gillette, *Macrosiphum rosae* Linnaeus, and *M. granarium* Kirby.

These larvae transformed after a larval instar averaging thirty-three and one-half days, the experimental period running from March 20 to April 28. Nine of these subsequently issued as adult flies (five males, four females) after a pupal instar averaging sixteen days.

The mature flies were smaller than nearly all the specimens of *stegnum* that the writer has ever collected in the field, and this fact suggests that the larvae of this species are not normally aphidophagous, or that these larvae were not supplied with their normal host aphids. In California as far as the writer recollects the species of *Melanostoma* have always been abundant in spring, but on only one occasion has he taken a larva in the field. Therefore it would appear that either the larvae are not aphidophagous or that normally they feed at night. In the insectary at Alhambra the larvae did most but not all of their feeding at night, and were very sluggish in the daytime, being

adept at concealing themselves from the light. Their behaviour in this respect was very dissimilar to that of the larvae of other aphidophagous species, such as *Catabomba pyrastri* Linnaeus, *Syrphus nitens* Zetterstedt, and *Eupeodes volucris* Osten Sacken, under simultaneous observations. This fact suggests that normally *Melanostoma* larvae feed at night.

The puparium of *M. stegnum* is light brown in general appearance. The integument becomes slightly more opaque with age, but is never more than semi-transparent. The anterior end is moderately bulbous. In outline the dorsum descends posteriorly in an even arch and the center is hardly concave. Length, 6 mm., maximum height and width, 2 mm.

Allowing the female flies a pre-oviposition period of five days the life cycle of *M. stegnum* was completed in two months.

**Melanostoma chaetopoda** new species

Two gravid females were collected in a field of peas infested with *Macrosiphum pisi* Kalt., on November 5, 1919, transported to the laboratory at Alhambra and placed in small wire screen cages enclosing pea plants infested with this aphid. The flies were fed diluted honey. Both died on November 7, each having deposited one egg. These eggs hatched in eight days, and the resultant larvae were placed in glass vials and offered aphids. One pupated on December 2 after a larval instar of twenty-six days, and the other was full grown on November 29 and remained alive without pupating until January 9, 1920. Both larvae were fed *Macrosiphum pisi*, and after November 23, when they cast the second molt, food records were kept. These showed that each of the larvae consumed nineteen aphids in the fourth instar. On January 2, 1920, a male fly emerged.

Between February 16 and April 4, 1920, seven females were collected in the field, transported to the insectary and placed in cages enclosing plants infested with aphids. Three deposited respectively four, six and three ova, the other four failing to oviposit and were possibly sterile. These females were fed with sugar water and lived in the cages from two to thirty days. Ten out of thirteen ova hatched after an average incubation stage of five and one-half days. On March 6 three larvae issued; from March 6 to 12 these were fed *Macrosiphum pisi*, from March

13 to 23 aphids on rose, from March 24 until pupation *Myzus rosarum* Walker. All three cast the second molt March 24 and thereafter the number of aphids (*Myzus rosarum* Walker, all instars) eaten was recorded. One larva consumed ninety aphids between March 24 and April 1, the date of its pupation; a second consumed two hundred and forty-seven between March 24 and April 4, when it pupated; the third died on April 1 after having eaten seventy aphids. Subsequently two male flies emerged after pupal stages of eighteen and twenty days respectively.

A female fly emerged April 22 after larval and pupal stages of seventeen and eighteen days respectively. This larva was raised on *Myzus rosarum* Walker and no incubation record was secured.

The egg and larval stages were shorter and the pupal stage longer than the corresponding stages of *M. stegnum* Say. The life cycle occupied about seven weeks in the insectary.

The egg is .9 mm. long by .24 mm. wide, chalk white; elevations of the chorion about twice as long as broad, in shape irregular. Eggs were deposited singly and not ranked.

The newly-hatched larva measures 1. mm. × .24 mm., and is pale yellow with the integument unarmed. Prior to the second molt the color changes to and remains greenish-yellow and the integument is smooth. At the time of the second molt the larva measures about 4.8 mm. x 1.4 mm. After this molt the color is light green with a dorso-median white stripe on the anterior two-thirds of the body. Towards the end of the instar the color becomes light brown with a pinkish suffusion. The posterior respiratory tubes are fused from the base almost to the apex; there is a slight constriction in the middle; the spiracular plates at the apices of the tubes are remote, brown, the spiracles straight narrow slits. The tubes are concolorous with the body color of the larva; each is slightly shorter than the combined basal width. The full grown larva is 10 mm. long, sub-cylindrical, very little flattened dorsally, transversely wrinkled and armed with few short pale hairs.

The puparium is 5.2 mm. long, 2.2 mm. wide, and 2.1 mm. in height. Color is light brown, the integument shows a black dorsal transverse bar at the anterior end, two black wavy lines

on the sides, a narrow black dorso-median stripe on the caudal half and many small black maculations all over. The anterior face of the puparium is bulbous, the dorsum evenly arched, the venter gently and shallowly concave. The body tapers laterally on the caudal half.

**Melanostoma obscurum,** variety **rostratum** Bigot (Pl. I. fig. E.)

Collections of adult females in the field, their transference to insectary cages containing plants infested with aphids, and observations on the habits of the forms were made as follows: On April 10, 1920, a female fly was placed in a cage containing a cabbage plant infested with the aphid *Aphis brassicae* Linnaeus. The following day eighteen ova were deposited on leaves and stem of the plant. Seventeen eggs were infertile, the single fertile egg hatching on April 19. On April 10 a second female was placed in a cage enclosing a horse bean plant infested with *Aphis rumicis* Linnaeus. The following day eighteen ova were deposited on the bean leaves. On April 17 fifteen eggs hatched. Both the flies died within two days of their capture. Between April 10 and 13 one male and six female flies were placed in a cage containing a pea plant lightly infested with the aphid *Macrosiphum pisi* Kalt. Thirty-three ova were obtained, and twenty-eight larvae hatched after an incubation period of four and five days. The last fly died eight days after its capture.

The egg measures .85 mm. in length by .36 mm. in width; elliptic oval, chalk white. The elevations of the chorion are irregular in shape and size, from six to two times as long as broad, the long axis parallel to that of the egg; they are connected by the usual fine ridges and occupy in the aggregate considerably more of the surface of the egg than the intervening sunken hyaline spaces do. The eggs were laid singly and not ranked.

The newly-hatched larva is cylindrical, smooth, and yellow in color.

Records of three larvae raised on an aphid diet in vials in the insectary at Alhambra, during the months of April and May 1920, indicated a larval stage of nineteen, twenty, twenty-three days. A fourth larva was full grown in thirty-one days after hatching from the egg but failed to pupate. Food records of these four larvae were made daily after the first molt, which in each case

occurred five days after hatching. One larva during its two final instars was supplied with rose aphids *Myzus rosarum* and *Rhopalosiphum nervatum* (instars iii and iv). It consumed a total of two hundred and seventy-eight aphids in fifteen days. A second supplied with the same aphids (instars iii, iv, v) consumed two hundred and eighty-two aphids in seventeen days. A third supplied with oak aphids *Myzocallis bellus* Walsh and *M. alhambra* Davidson (instars i to iv) consumed three hundred and forty-six aphids in thirteen days. The fourth larva which failed to pupate was supplied with similar aphids and consumed two hundred and nineteen in twenty-five days. Although the casting of the second molt was not observed, it appeared, from the rate of feeding of the larvae, that this skin was cast three or four days after the first molt had taken place. There is always a notable increase in the number of aphids eaten immediately following a molt of the syrphid larva. During the last three days of the larval stage few aphids were eaten.

After the first molt the larva is light green, on the medio-dorsum a white interrupted longitudinal stripe occurs. The cauda is truncate, the body inconspicuously armed with short pale hairs and wrinkled transversely. The dorsal stripe is doubly interrupted so as to leave a diamond-shaped whitish spot. Toward the end of the second instar the general color turns brown and the median stripe fades.

In the third instar the color is light brown. The whitish dorsal stripe is broken up to form a series of diamond-shaped spots. The vestiture is scanty and short.

The full grown larva is about 10 mm. long and 2 mm. wide. The ground color is light brown. On each side is a narrow longitudinal dull white stripe and down the medio-dorsum is an interrupted whitish stripe, the interruptions causing the formation of three diamond shaped spots. The body is transversely wrinkled and laterally carinate. The vestiture consists of scanty short pale hairs. The posterior respiratory tubes are light brown, fused except at their apices; each tube as broad at the base as it is long. The spiracular plates are remote, dark brown, each bearing three straight slit-like spiracles.

The puparium measures 5.8 mm. × 2.7 mm. × 2.4 mm., light brown in color, paler on dorsum and sides; dorsum arcuate, more

abruptly so on the anterior end, behind descending in an even curve to the cauda; venter gently concave; body narrowing caudad so that at the base of the posterior respiratory tubes its width is half that at the widest part-anterior third.

In May 1920 three individuals passed the pupal stage respectively in sixteen, sixteen, seventeen days.

The cycle, egg to adult, occupied about forty-two days for this species. This cycle is about as long as that of *M. chactopoda* but shorter than that of *M. stegnum* Say.

The question as to whether the larvae of Melanostomae are normally entomophagous has been referred to above. Prof. C. L. Metcalf found that in Maine those of *Melanostoma mellinum* Linnaeus readily ate the aphids *Myzus persicae* Sulzer and *Aphis cornifoliae* Fitch, but refused several other species[3]. Mr. C. Howard Curran in a letter to the writer stated that in Ontario he found that the larvae of *M. obscurum* Say consumed both aphids and decomposing chickweed, and that they were more successful on the latter diet. In this connection it can be said that from the writer's observation the young larvae of the well-known aphidophagous syrphid *Allograpta obliqua* Say, are able to sustain themselves at least through the first few days of their larval life on plant food. In the cages at Alhambra there was no decomposing plant matter and the female *Melanostoma* flies deposited all their eggs on the plants, indicating some attraction to the aphids or to the healthy plants. While the individuals of *M. stegnum* raised on a diet of aphids became undersized imagines, those of the other two species became normal adults. It is possible that several of the species of *Melanostoma* are both phytophagous and entomophagous in the larval stage, and even that these are undergoing a transition in habit, changing from plant- to insect-feeders. The nocturnal habit of feeding and desire for concealment suggests that it may not have been so long ago that the larvae normally lived in obscurity inside plants, or in the open in darker situations than growing plants normally afford.

## Explanation of Plate I

Fig. D.—Eggs of *Melanostoma stegnum* Williston on bean leaf. Photograph taken at Alhambra, California, March 20, 1920.

Fig. E.—*Melanostoma obscurum* Say, var. *rostratum* Bigot. Full grown larvae. Photograph taken at Alhambra, California, April 27, 1920.

[3] Me. Agr. Exp. Sta., Bull. 253, "Syrphidae of Maine."

# NEW GENERA AND SPECIES ON MELANOPLI FOUND WITHIN THE UNITED STATES AND CANADA
## (ORTHOPTERA; ACRIDIDAE)

BY MORGAN HEBARD

## Part IV

Over a year ago, the third part of the present series of papers appeared.[1] Since that time our study of the North American Melanopli has made some progress, the manuscript having been prepared as far as the genus *Acoloplus*. Press of work on exotic material has prohibited a more rapid advance, however, and for this reason we believe it best to describe, at the present time, the four additional new species and two geographic races which have been encountered.

Among these the distinctive *Bradynotes chilcotinae* is of particular interest. Added to the very large series of specimens available for study, the valuable information on this insect furnished by Mr. E. R. Buckell requires our very cordial thanks to that gentleman for such kind and thorough cooperation.

The discovery, by Dr. Witmer Stone, of another species of *Melanoplus* in the isolated Canadian Zone of the Chiricahua Mountains of Arizona, shows again the necessity for further careful work in such environment on all of the higher ranges of the Southwest.

A total of five hundred and seventy-three specimens are here recorded. In the present series of papers to date, a total of two genera, thirty-eight species and six geographic races have been described.

As is our custom, the location of all the material is indicated excepting that collected by Rehn and Hebard. This material is at present all in the Philadelphia Collections.

**Agroecotettix modestus aristus** new subspecies (Plate II, figs. 1, 2 and 3.)

Compared with the female type of *A. modestus modestus* Bruner, described from Lerdo, Durango, Mexico, females

[1] Trans. Am. Ent. Soc., XLVI, pp. 355 to 403, (1920).

assigned to the present geographic race are distinguishable by their more robust form, with pronotum presenting a slightly more swollen appearance and less definition between the disk and lateral lobes, much broader tegmina, which are attingent, and caudal tibial coloration, these members being bright red distad.

Males of the present race are similar to the females except as described below, the deeply forked cerci being distinctive. In general form they are more nearly comparable to males of *Phaulotettix compressus* (Scudder), than to those of the species of other North American genera of the Melanopli. From the latter they differ in the more flattened frontal costa, more inflated pronotum, with transverse sulci more decided and caudal margin feebly but distinctly convex, much broader and nearly attingent tegmina, small blunted and well separated furcula, much broader supra-anal plate, furcate cerci, prominent pallium, shallower and differently shaped subgenital plate and distinctive coloration.

*Type.*—♂; Uvalde, Uvalde County, Texas. Elevation, 1000 to 1100 feet. August 21, 1912. (Rehn and Hebard.) [Hebard Collection, Type no. 749.]

Size medium large; form robust, when compared with species of nearest affinity. Head large, eyes large and prominent, the greatest width across the eyes approximating the greatest pronotal breadth. Vertex much as in *Phaulotettix*, slightly produced and bluntly rounded, its dorsal surface moderately concave particularly between the eyes, where delicate convex lateral carinae are distinct and approximate. Frontal costa broad and flat, showing weak depression about the median ocellus, below that point gradually disappearing into the face.

Pronotum with dorsal and lateral portions of prozona smooth, but with a few impressed punctae laterad and somewhat inflated between the decided transverse sulci, which sever the medio-longitudinal carina, this carina distinct except between the transverse sulci, where it is very weak.[2] Pronotal lateral carinae, which are subobsolete through the lateral margins of the disk, are apparent on the prozona, due to the color pattern; metazona impresso-punctulate, the caudal margin of the disk weakly but distinctly convex. Tegmina very broad oval, extending slightly beyond caudal margin of metanotum, separated by a very slight interval. Minute, very elongate oval, vestigial wings present, concealed by the tegmina. Large, open tympana covered by the tegmina.

[2] Apparently variable in this portion, as it is subobsolete to distinct in the large series before us of the Trans-Pecos Texan race (*M. m. cryptsidomus*) of the species.

Distal portion of abdomen distinctly, though not decidedly, enlarged. Furcula represented by two broad and well separated, very brief convexities, which extend very slightly beyond the margin of the tergite. Supra-anal plate with length about equal to width, broadly rotundato-triangular, lateral portions broadly and weakly concave, with a minute node mesad; median portion weakly elevated and rather broadly and weakly concave. Cercus over four times as long as its proximal width, bifurcate at end of proximal three-fifths, proximal portion narrowest at its median point (where it is about one-third as broad as long) due to the concavity of the dorsal margin, ventral margin straight throughout, except that feeble convexity is indicated proximad; internal section of distal portion produced in a straight, flattened finger, subequal in width, about three times as long as broad, with greatest thickness vertical and apex rounded, this finger directed meso-caudad; external section of distal portion produced in a straight slender spike, with apex very narrowly rounded, longer than internal section and directed caudad, so that the axes of these portions form an angle of something less than ninety degrees.

Subgenital plate with depth about one-half length of the free margin, that margin weakly concave laterad and feebly angulato-convex mesad. Prosternal spine rather sharply conical, showing a weak flexure cephalad. Interspace between mesosternal lobes nearly twice as long as wide. Cephalic and median femora heavy, inflated and bowed. Caudal femora rather short and very robust, though proportionately not as short and robust as in *Phaulotettix compressus*. Caudal tibiae with eight to ten spines. Caudal tarsus distinctly less than half as long as caudal tibia.

*Allotype.*—♀; same data as type. [Hebard Collection.]

Agrees closely with male in coloration and relative proportions; differing in the following features. Size larger, form moderately stouter. Vertex proportionately slightly broader. Tegmina proportionately broader, attingent. Genitalia normal, the ovipositor valves stout, with denticulations of dorsal margin of dorsal pair blunt, heavy and irregular and with the stout apices acute and well curved. Interspace between mesosternal lobes about one and one-half times as long as broad.

*Measurements (in millimeters)*

| ♂ | Length of body | Length of pronotum | Width of pronotum | Length of tegmen | Width of tegmen | Length of caudal femur |
|---|---|---|---|---|---|---|
| Uvalde, Texas, *type* | 21.7 | 5.3 | 4.9 | 4 | 3 | 12.2 |
| Uvalde, Texas, *paratypes* | 21.7–23.3 | 5.6–5.8 | 5.1–5.2 | 3.8–4 | 3–3.2 | 12.8–13 |
| Laredo, Texas | 22.3 | 5.8 | 5.2 | 4 | 3.8 | 12.9 |
| ♀ | | | | | | |
| Uvalde, Texas, *allotype* | 31.2 | 7.8 | 7 | 4.8 | 4.6 | 16 |
| Uvalde, Texas, *paratypes* | 30.3–30 | 7.3–7.3 | 6.7–6.8 | 5–4.3 | 4.2–4.2 | 15.8–15.3 |
| Laredo, Texas | 28 | 6.8 | 6 | 4.8 | 4.3 | 14.2 |

In the present series the width of the caudal femur is; ♂, 4 to 4.1; ♀, 4.8 to 5 mm. The tegmina slightly overlap in the Laredo male, in the others the interval between these organs is .25 to .35 mm.

Larger series are needed to determine whether the tegminal differences, which appear to aid in separating the races of this species, are constant in this race and *modestus modestus*.

General color ochraceous-buff (individually tinged with ochraceous-tawny, varying to yellow-ocher), with a conspicuous round spot of ochraceous-buff laterad near base of tegmina. Head marked with blackish as follows: medio-longitudinally on the dorsal surface in a band which is divided by a pale line caudad, with a postocular streak, flecks on the genae and with a transverse band on each side beneath the antennal sockets terminating at the margins of the frontal costa. Pronotum with medio-longitudinal band continued on prozona, there dividing and then converging and forming a very narrow oval, thence quickly becoming obsolete on the metazona; medio-longitudinal carina, sulci and prozonal portion of lateral lobes pictured with blackish, the sutures of the pleura and periphery of the pale spot also blackish. Tegmina with the multitude of minute veins ochraceous-tawny, the minute interstices mummy-brown. Abdomen with proximal tergites irregularly suffused with blackish meso-laterad. Ventral surface paler, usually tinged with yellow-ocher, sutures of abdominal sternites black, male subgenital plate with a median fleck of black. Cephalic and median limbs immaculate, of the general coloration. Caudal femora with two heavy transverse bands and a dorso-proximal suffusion of blackish, the first (median) band becoming oblique on the external pagina, ventral margin of external pagina with a few heavy black flecks, genicular areas black laterad except for entire area of genicular lobes which is yellow-ocher; internal face of caudal femora antimony yellow, tinged with coral-red ventro-proximad and crossed by the more distal of black bands. Caudal tibiae of general coloration proximad, with a blackish ring at end of swollen portion, and with flecks of blackish or suffused with that color at end of proximal third, remaining two-thirds bright coral-red, spines and spurs buffy tipped with black, except proximo-internal spines which are wholly black.

*Specimens Examined*: 8; 4 males and 4 females.

Texas: Uvalde, Uvalde County, 1000 to 1100 feet, VIII, 21, 1912, (R. and H.), 3 ♂, 3 ♀, *type*, *allotype*, *paratypes*. Laredo, Webb County, 550 feet, VIII, 12, 1912, (R. and H.), 1 ♂, 1 ♀.

Like *Rhabdolcttix*, this species is thamnophilous and usually found in thorn bushes, but it is also frequently encountered in other vegetation affording security. The comparative scarcity of the present race, in the small portion of the United States in which it occurs, causes us to believe that, in adjacent northern Mexico, *modestus aristus* will be found to have a very much wider distribution, occurring there much more abundantly.

**Agroecotettix modestus crypsidomus** new subspecies[3] (Plate II, figs. 4, 5 and 6.)

1917. *Agroecotettix modestus* Hebard, Proc. Acad. Nat. Sci. Phila., 1917, p. 263. [♀; Monclova, Coahuila, Mexico.]

The present geographic race is separated from *A. modestus aristus*, here described, by the average smaller size and less swollen pronotum. Males are further separated by the shorter cerci, the forks of which are much shorter, with the external arm shorter than the internal arm. Females are less readily distingished by the proportionately smaller tegmina, which are separated by a moderate interspace.

Compared with the type of *A. modestus modestus* Bruner, a female, individuals of that sex of the present race are distinguished by their smaller size and red coloration of the distal portions of the caudal tibiae. The slightly more swollen pronotum and form and position of the tegmina show a development approximately intermediate between that of *m. modestus* and *m. aristus*.

The discovery of males of *m. modestus* will aid greatly in defining accurately the relative position of the races of the species.

*Type.*—♂: Marathon, Brewster County, Texas. Elevation, 3940 to 4160 feet. September 12, 1912. (Rehn and Hebard.) [Hebard Collection, Type no. 750.]

Agrees fully with *m. aristus*, described on page 50, except in the following characters. Size smaller, medium. Vertex distinctly narrower. Inflation of prozonal portion of pronotum less decided. Cercus about three times as long as its proximal width, proximal portion narrowest at its median point (where it is about one-third as broad as long), due to the concavity of the dorsal margin, ventral margin straight throughout, except that feeble convexity is indicated proximad; internal section of distal portion produced in a straight, flattened finger, subequal in width, about twice as long as broad, with internal surface moderately convex and external surface flattened and moderately oblique, apex rounded, this finger directed meso-caudad; external section of dorsal portion produced in a straight, rapidly tapering spike, with apex very narrowly rounded, very slightly shorter than internal section and directed caudad, so that the axes of these parts form an angle of something less than ninety degrees.

In the large series at hand the extremities of the male cerci show some variation in length and form. The external production is usually decidedly shorter than the internal production, rarely nearly as elongate.

[3] From κρυφί-δομος = dwelling in secret places.

*Allotype.*—♀; same data as type. [Hebard Collection.]

The female sex of the present race differs from males as described for the female of *m. aristus* on page 51 except that the tegmina are more similar and are always moderately well separated.[4] Interval between the mesosternal lobes less than one and one-half times as broad as long.[5]

*Measurements (in millimeters)*

| ♂ | Length of body | Length of pronotum | Width of pronotum | Length of tegmen | Width of tegmen | Length of caudal femur |
|---|---|---|---|---|---|---|
| Sanderson, Texas (6) | 17–18.8 | 4.6–4.8 | 4.1–4.2 | 2.8–3.2 | 2.3–2.8 | 10.1–11.3 |
| Marathon, Texas, *type*, | 20 | 5 | 4.8 | 3.4 | 2.8 | 11.8 |
| Marathon, Texas, *paratypes*, (42) | 17.4–22.2 | 4.2–5 | 4.1–4.8 | 3–3.6 | 2.7–3 | 10.5–12 |
| Persimmon Gap, Texas, (2) | 16.4–17 | 3.8–4 | 3.7–3.9 | 2.6–3 | 2.3–2.4 | 9.8–10.4 |
| Moss Well, Texas, (22) | 18–20 | 4.1–5.1 | 4–4.9 | 3–3.6 | 2.6–2.9 | 10.4–12 |
| ♀ | | | | | | |
| Sanderson, Texas, (7) | 19.3–25 | 5–6 | 4.8–5.4 | 3–4 | 2.7–3.3 | 11.3–13.8 |
| Marathon, Texas, *allotype*, | 26.3 | 6.2 | 5.9 | 4 | 3.3 | 14 |
| Marathon, Texas, *paratypes*, (42) | 22.2–27.2 | 5–6.7 | 5–6.3 | 3.2–4.3 | 2.8–3.3 | 12.3–14.2 |
| Pine Mountain, Tex., | 28 | 6 | 6 | 4.2 | 3.4 | 14 |
| Persimmon Gap, Texas, (4) | 19.2–24.2 | 4.8–5.6 | 4.5–5.2 | 3–3.8 | 2.8–3.1 | 11.5–13.7 |
| Moss Well, Tex., (19) | 22.3–28.6 | 5.1–5.9 | 5–5.9 | 3.9–4.2 | 2.8–3.3 | 12.1–13.8 |

For convenience in comparing the measurements, we give the following for the type of *modestus modestus* Bruner, a female from Lerdo, Durango, Mexico. Length of body, 31.1; length of pronotum, 6.9; width of pronotum, 6.5; length of tegmen, 4.9; width of tegmen, 3.7; width between tegmina, 2.3; length of caudal femur, 15.8; width of caudal femur, 4.8 mm.

The extremes of caudal femoral width are; ♂, 3 to 3.8; ♀, 3.1 to 4.4 mm. The variation in width of the interval between the tegmina is; ♂, .1 to .8; ♀, .8 to 1.7 mm.

In general coloration the present race agrees closely with *modestus aristus*, except that the majority of specimens have the general coloration darker, sayal brown, sometimes as deep as suffused bister. In consequence, the markings are less striking and the general appearance not as brilliant. The dark markings of the pronotal disk show decidedly less curvature, in the great majority of specimens being subparallel and in a few of maximum in-

[4] Varying in the large series at hand from .8 to 1.7 mm.

[5] Varying in the series to very slightly broader than long, thus showing anew that this space is individually decidedly variable in the Melanopli, and can certainly not be used as of high generic or specific significance as was supposed by Scudder.

tensive coloration fusing, so that in this region there is a dark medio-longitudinal band. In the darker specimens, the dark bars of the caudal femora are much less conspicuous and indeed are obsolete in a few of these.

The markings of the pronotal disk and darker general coloration show closer agreement with the type of *modestus modestus*. The present material, like that of *modestus aristus*, however, differs from that race in the red of the distal portions of the caudal tibiae and the ventro-proximal portion of the internal faces of the caudal femora.

*Specimens Examined*: 192; 88 males, 102 females and 2 immature individuals.

Texas: Sanderson, Terrell County, 2800 to 3150 feet, VIII, 25, 1912, (R. and H.), 6 ♂, 7 ♀. Marathon, Brewster County, 3900 to 4160 feet, VIII, 26 to IX, 13, 1912, (R. and H.), 43 ♂, 43 ♀, *type, allotype, paratypes*. Garden Spring, Brewster County, IX, 2, 1912, (R. and H.), 1 ♂ 3 ♀, 2 juv. Persimmon Gap, Brewster County, 3000 feet, IX, 10, 1912, (R. and H.), 2 ♂, 4 ♀. Avery Canyon, Grapevine Hills, Brewster County, 3000 feet, IX, 4, 1912, (R. and H.), 1 ♂, 1 ♀. Neville Spring, Brewster County, 3250 to 3300 feet, IX, 8, 1912, (R. and H.) ,1 ♂, 2 ♀. Moss Well, Chisos Mountains, 4500 to 5000 feet, IX, 5 to 8, 1912, (R. and H.), 22 ♂, 19 ♀. Lost Mine Peak, Chisos Mountains, 6000 feet, IX, 6, 1912, (R. and H.), 1 ♂, 1 ♀. Canyon behind Pulliam Bluff, Chisos Mountains, 5000 feet, IX, 7, 1912, (R. and H.), 9 ♂, 17 ♀. Pine Mountain, Davis Mountains, 6250 feet, VIII, 29, 1912, (R. and H.), 1 ♀. Maguires Ranch, upper Limpa Canyon, Davis Mountains, 5600 feet, VIII, 29, 1912, (R. and H.), 1 ♀. Quitman Mountains, El Paso County, 4800 to 5400 feet, IX, 14, 1912, (Hebard), 2 ♂, 2 ♀.

Mexico: Monclova, Coahuila, IX, 20, (E. Palmer), 1 ♀, [Mus. Comp. Zool.].

Not only was this insect often found abundant in the catclaw and other thorny shrubs, in the semi-desert areas of Trans-Pecos Texas, but it was also seen frequently to seek shelter in the sotols (*Dasylirion* sp.). It was found at elevations from 2800 to 6250 feet, but was never met with in any numbers above the 5000 foot level in either the Chisos or Davis Mountains.

**Conalcaea coyoterae**[6] new species (Plate III, figs. 1, 2 and 3.)

This insect is related to *C. huachucana* Rehn. It agrees closely in all features except that in most of the specimens before us the caudal femora are not conspicuously bicolored[7], the

[6] The Coyotero Apaches, "Wolf-Men", inhabited the region from which the present species is known.

[7] In a single male, from Bill Williams Mountain, the coloration of the caudal femora is exactly as in *huachucana*. It would appear that no feature of coloration is of sufficient constancy, over the range of these species, to warrant its use as an unqualified diagnostic criterion.

male cerci are shorter with distal portion proportionately much broader and distal margin rounding strongly to the less produced ventro-caudal angle, while the male subgenital plate is shorter and not as sharply conical (for *huachucana* see plate III, figures 4 and 5).

In the coloration of the caudal femora, *coyoterae* agrees more closely with *C. miguelitana* (Scudder), in all other respects being, however, the opposite extreme of the forms of this stock, *huachucana* occupying an intermediate position in the form of the male cerci.

*Type.*—♂; Prescott, Arizona. Elevation, 5400 feet. July 21, 1917. (J. A. Kusche.) [Hebard Collection, Type no. 751.]

Size rather large compared with species of allied genera; form robust, subfusiform. Head as in *huachucana*[8], small in proportion to the body bulk, distinctly narrower than greatest pronotal width, scutellum of the fastigium weakly concave between the very delicate but distinct lateral carinae, frontal costa weakly concave toward the median ocellus, eye distinctly over one and one-half times as long as infra-ocular sulcus. Pronotum, tegmina and abdomen as in *huachucana*. Furcula represented by thickenings of the tergite, causing weak and well separated angulations of the margin. Supra-anal plate triangular with apex blunted, nearly as long as wide, median sulcus broad and percurrent, deepest in proximal half, lateral portions weakly and broadly concave, with a minute conical projection near the lateral margins at two-fifths the distance to the apex.[9]

Cercus narrowing in proximal third, thence widening greatly, due to expansion dorsad, the ventral margin being broadly and evenly convex throughout, the dorsal portion of the expanded section (which is nearly twice as wide as the proximal width and nearly half as wide as the cercal length) convex to the acute-angulate, briefly produced ventro-caudal angle (the apex). Subgenital plate conical, its apex blunt, shorter and blunter than in *huachucana*. Cephalic and median femora somewhat inflated and weakly bowed.

*Allotype.*—♀; Prescott, Arizona. Elevation, 5400 feet. July 31, 1917. (O. C. Poling.) [Hebard Collection.]

Very similar to females of *huachucana*, except that the caudal femora are not contrastingly colored, the external pagina of the general brown coloration, feebly and not solidly suffused with a darker shade.

Differs from the male in the following features. Size decidedly larger, form much more robust. Eye less than one and one-half times as long as infra-ocular sulcus. Even widening of the pronotal disk as regular but decidedly stronger. Ovipositor valves with stout apices moderately elongate and weakly curved, blunt teeth of dorso-external margin of dorsal valves large and irregular. Cephalic and median femora not inflated; the former nearly straight, the latter straight.

[8] Rehn's excellent description is best referred to; Proc. Acad. Nat. Sci. Phila., 1907, p. 48, (1907).

[9] Also found in *huachucana*.

*Measurements (in millimeters) of extremes*

| ♂ | Length of body | Length of pronotum | Width of pronotum | Length of tegmen | Width of tegmen | Length of caudal femur |
|---|---|---|---|---|---|---|
| Prescott, Arizona, *type*, | 18.5 | 4.2 | 4.2 | 4 | 1.9 | 11.2 |
| Prescott, Arizona, *paratypes*, (18) | 17-19.2 | 4.2-4.4 | 3.9–4.2 | 3.2–3.8 | 1.9–1.7 | 11-11.1 |
| Mount Union, Prescott, Arizona | 20 | 4.9 | 5 | 3.9 | 2 | 12.8 |
| Bill Williams Mountain, Arizona | 21 | 5 | 5 | 4.2 | 1.9 | 13 |
| ♀ | | | | | | |
| Prescott Arizona, *allotype*, | 26 | 5.9 | 6.3 | 5.5 | 2.3 | 14.8 |
| Prescott, Arizona, *paratypes*, (42) | 21–30 | 5.1–6.3 | 5.4–7.2 | 4.7–5.4 | 1.9–2.5 | 12.7-15.7 |
| Mount Union, Prescott, Arizona, (3) | 24.7–29.4 | 6.3–6.1 | 6.7–6.8 | 4.8–4.6 | 2.1–2.1 | 15-15.4 |

The width of the caudal femur in the series is: ♂, 3 to 3. 4; ♀, 3. 4. 4–4. 1 mm.

Coloration very similar in the series, except that in the males the average is slightly more contrasting and brilliant. Occiput, disk of pronotum and dorsal surface of mesonotum and metanotum dull sayal brown (individually varying from cinnamon to warm sepia in the specimens of maximum recessive and intensive coloration). Cephalic and median limbs of this coloration, showing vague irregularities of shade. Dorsal surface of male abdomen, in proximal half shining blackish brown laterad, with a narrow medio-longitudinal band of pinkish cinnamon, remaining portions sayal brown; in females much more uniform, less shining, with latero-proximal portions only slightly darkened and medio-longitudinal band very weakly defined, in some individuals unicolorous. Remaining portions of head, lateral lobes of pronotum and underparts clay color, except for a weakly defined postocular bar on each side of the head (heavy in occasional specimens), which is continued on the dorsal portion of the pronotal lateral lobes as a broad, solidly colored, shining black band, in females often weak cephalad and caudad. On the sides, the meta-episternum and the meta-epimerum are shining black. Tegmina cinnamon-buff to clay-color in dorsal half, blackish brown to black and usually shining in ventral half. Caudal femora of the general coloration dorsad, paling to the ventral coloration ventrad, the external pagina vaguely and not solidly suffused with a darker shade, which in some females shows a faintly greenish tinge. Caudal tibiae varying from grenadine to peach red.

This type of caudal femoral coloration is strikingly different from the normal for *huachucana*, but a single male is before us agreeing fully in this respect with that species. In that individual the external pagina is strikingly bicolored, the dorsal portion almost black, the ventral portion ochraceous-buff.

We would note that the usual difference from *huachucana* in the caudal femoral coloration is also shown in the immature stages, when dark markings

are there present. In some of the juveniles the caudal femora are immaculate, the majority having, however, the entire external pagina black, except for invasions of the light general coloration. These invasions, when decided, break the black area into characteristic Melanoploid bands, which are continued across the dorsal surface of the femora.

Like the other species of this genus, the present is probably strictly geophilous, agreeing with *huachucana* in being an inhabitant of the Encinal, or Region of Oaks, in Arizona. The entire series was taken at elevations of from 5400 to 6500 feet.

*Specimens Examined*: 115; 20 males, 76 females and 19 immature individuals. ARIZONA: Bill Williams Mountain, IX, 14, 1917, (O. C. Poling), 1 ♂, [Hebard Cln.]. Prescott, VII, 5 to VIII, 24, 1917, (Poling; Kusche), 19 ♂, 68 ♂, 19 juv., *type*, *allotype*, *paratypes*, [Hebard Cln.]. Granite Peak, Prescott, VIII, 17, 1917, (J. A. Kusche), 4 ♀, [Hebard Cln.]. Mount Union, Prescott, VIII, 15, 1917, (J. A. Kusche), 1 ♂, 3 ♀, [Hebard Cln.]. Senator, Yavapai County, VIII, 12, 1917, (J. A. Kusche), 1 ♀, [Hebard Cln.].

**Bradynotes chilcotinae** new species (Plate III, figs. 6, 7 and 8.)

This species is readily separable from any of the previously known forms by the large triangular furcula of the male and other genitalic features in this sex.

In form it agrees best with *B. caurus* Scudder, the definition between the disk and lateral lobes of the pronotum being weakest in these species. In coloration it is dark, showing the greatest reduction of the brilliant colors found on the caudal limbs in the majority of the species of *Bradynotes*.

The caudal tibiae are buffy, as in *B. albida* Hebard, *B. excelsa* Rehn and *B. satur* Scudder, but these members are often strongly suffused in the present insect.

The male cerci often fail to reach as far distad as the apex of the supra-anal plate and are as slender at their apices as in *B. compacta* Morse[10]. The male supra-anal plate, though subject to considerable variation, is seen to be never of the simple, longer type developed in *B. obesa* (Thomas) and its closer allies, in which the lateral margins are weakly concave convergent to the broadly rounded apex.

Type.—♂; Riske Creek, Chilcotin, British Columbia. July 22, 1921. (E. R. Buckell.) [Canadian National Collection.]

Size medium large for the genus; form heavy, though not as heavy as in *obesa* and its closer allies; surface moderately pilose. Head broad and full, vertex gently tumid; fastigium shallowly concave, the lateral margins thick,

[10] Compare, Trans. Amer. Ent. Soc., XLV, pl. XXIX, fig. 11, (1919).

rounded and very weakly defined, the width at the ocelli decidedly greater than between the eyes; frontal costa comparatively broad and shallowly concave, with lateral margins rounded and very weakly defined, surface rather decidedly impresso-punctate; least width distinctly greater than that of proximal antennal joint, greatest width between antennal bases. Eyes slightly longer than infra-ocular sulcus.

Pronotum much as in *caurus*, the weakly convex disk curving into the lobes, with the low and broadly rounded lateral carinae subobsolete; disk expanding very slightly caudad, medio-longitudinal carina obsolete, except very briefly cephalad on prozona and on metazona caudad of the principal sulcus, continued on abdomen but very weak and obsolete on proximal tergites. Tegmina and wings absent.

Furcula represented by a pair of large, triangular projections, which form mesad an obtuse-angulate emargination and have their external margins straight, longitudinal; these processes are broader than long, but in length from base of their tergite exceed one-fourth the length of the supra-anal plate.[11] Supra-anal plate broad, its length equal to (varying in the series to slightly greater than) its basal width; lateral margins weakly convergent and very weakly convex to distal portion, where on each side a very strongly obtuse-angulate emargination is indicated; (in the series at hand the apex of the plate varies from sharply triangular to very strongly rounded-triangular, the emargination laterad varying from obsolete to strongly defined,) surface deeply concave laterad, with a broad medio-longitudinal concavity, which is strong proximad, very weak mesad and shallow distad.[12]

Cerci shorter than (varying in the series to as long as) the supra-anal plate, tapering gradually from the broad base to the very slender, rounded apex. Subgenital plate full, conical, free lateral margins weakly convex to the very blunt apex, which is entire and is produced caudad but not elevated. Cephalic and median femora moderately inflated, very feebly bowed.

*Allotype*.—♀; same data as type, but taken June 24, 1921. [Canadian National Collection.]

Larger and more robust than male. Fastigium of vertex and frons: frontal costa much broader and with surface much more weakly concave, the surface of the latter impresso-punctulate. Eye in length approximately that of infra-ocular sulcus. Pronotum moderately broadened caudad, its convexity very weakly interrupted by the subobsolete lateral carinae, which scarcely delimit the disk from the lateral lobes; medio-longitudinal carina subobsolete, obsolete on the three succeeding segments, but again weakly indicated on the abdominal tergites. Ovipositor valves much as in *satur*, the dorsal pair showing weaker curvature than in *obesa*. Cephalic and median femora neither inflated or bowed.

[11] Though somewhat variable in length and width, these projections are seen to be constant in general contour in the very large series under consideration.

[12] In no specimens could the type of this plate be confused with that of *obesa* and its closer allies.

*Measurements (in millimeters) of extremes*

| | Length of body | Length of pronotum | Width of pronotal disk cephalad | Width of pronotal disk at principal sulcus | Length of caudal femur |
|---|---|---|---|---|---|
| ♂ | | | | | |
| *Type* | 21.4 | 4.2 | 2.8 | 3.4 | 11.7 |
| *Paratypes*, (8.5)[13] | 21–25 | 4–5 | .... | .... | 11–12.5 |
| Big Bar, British Columbia, (4) | 17–18.5 | 3.7–3.8 | 2.5–2.6 | 3.2–3.3 | 10.3–10.4 |
| ♀ | | | | | |
| *Allotype* | 24 | 4.8 | 3.8 | 4.8 | 13.4 |
| *Paratypes*, (78)[13] | 24–40 | 4.8–6 | .... | .... | 12.5–15 |
| Big Bar, British Columbia,(2) | 21.5–22.2 | 4.2-4.3 | 3.3–3.3 | 4.1–4.2 | 12.3-12.2 |

The size reduction shown by the Big Bar specimens is probably attributable to different local environmental conditions.

General coloration of dorsal surface of males chestnut-brown, deepening to shining blackish brown proximad on sides of abdomen, except ventrad toward margins of tergites, where narrow invasions of the buffy color of the ventral surface occur. Ventral surface light ochraceous-salmon, or antimony-yellow with a salmon tinge. Frontal costa, face, genae and ventro-lateral portions of pronotum and thorax buffy, darkened by very numerous dots and flecks of dark brown. Cephalic and median limbs similar, but not as much darkened. Pronotal lateral lobes with dorsal portion slightly darker and more shining than disk, this weakly defined band continued on the sides of the thorax.

Caudal femora buffy, with minute flecks and dots of dark brown, dorsal and external faces with two broad bands of chestnut-brown, which are oblique on the external pagina, the genicular areas also darkened. In many specimens these portions are often greatly suffused, in some so dark that the bands have become almost obsolete. Internal surface of caudal femora proximad and ventro-internal surface distad vinaceous rufous or dragons blood red. Caudal tibiae buffy, frequently strongly washed with mummy brown; spines and spurs buff proximad, black distad.

The females vary in general coloration from chestnut-brown to prout's brown and are much more uniform, the darker bands of the body and caudal femora being subobsolete or absent. In this sex the ventral surface of the doby appears to be light brown, but is seen to be usually much discolored and darkened in dried specimens.

Mr. Buckell writes that this insect is "extremely common in semi-sylvan locations, especially in upland pastures beneath the aspens (*Populus tremuloides*). In some places it is the commonest grasshopper to be found." The species was found hatching

[13] These measurements were taken by Mr. Buckell, from the material before drying.

as early as May 1st, while adults were numerous and freely pairing by July 20th. In early August it had become scarce, but about the middle of September many adults were again found, pairing freely, and the species was still common in October

These interesting notes by the energetic discoverer of this new species indicate that, in the Chilcotin, it is probably double brooded.

We are told that individuals are much sought after by the Indians for fish bait.

*Specimens Examined*: 245; 137 males and 108 females.

British Columbia: Riske Creek, Chilcotin, VI, 20, 1920, 3 ♂, 3 ♀; IX, 18, 1920, 1 ♂, 1 ♀; IV, 18, 1921, 38 ♂, 27 ♀; V, 30 to VIII, 1, 1921, 91 ♂, 75 ♀, *type*, *allotype* and all others *paratypes*, (all taken by E. R. Buckell).[14] Big Bar, 7400 feet, VII, 9, 1921, (E. R. Buckell), 4 ♂, 2 ♀.

**Melanoplus chiricahuae** new species (Plate III, figs. 9 and 10.)

This handsome insect agrees closely in size, coloration and general appearance with *M. femur-nigrum* Scudder, a species known from the northern portion of the Arizona Plateau.

In male cereal development nearest approach is found in *M. calidus* Scudder, which species occurs in the White and Sacramento Mountains of south-central New Mexico. The cerci of that species are, however, much broader and shorter, with broadened apical portion more conspicuously truncate. In other features wide differentiation between these two species occurs, *chiricahuae* being clearly much more closely related to *femur-nigrum*.

*Type*.—♂; Ida's Peak, Chiricahua Mountains, Cochise County, Arizona. Elevation, 8000 feet. June 28, 1919. (Witmer Stone.) [Acad. Nat. Sci. Phila., Type no. 5381.]

Size and form medium for the group. Vertex and frontal costa as in *femur-nigrum*. Eye large, nearly twice as long as infra-ocular sulcus. Pronotum as in *femur-nigrum*: medio-longitudinal carina weak on prozona, very weak between transverse sulci, moderately decided on remaining portion of metazona, sulci distinct but not deep; lateral margins of pronotal disk subparallel to principal sulcus, caudal margin of same broadly obtuse-angulate produced with apex rounded. Prosternal spine longer than broad, slightly transverse, cylindrical to distal portion which tapers off strongly to the rounded apex. Tegmina very slightly longer than pronotum, almost attingent, oval, with apex rounded, though not broadly so.

[14] The bulk of this series is in the Canadian National and Philadelphia Collections. Sets, however, will be sent to the other larger North American collections of Orthoptera.

Furcula represented by two minute projections, with bases weaky convex to base of their tergite, the projecting portions slightly longer than wide. Supra-anal plate shield-shaped, with lateral margins proximad straight and parallel for a short distance, then moderately raised, very weakly concave and convergent to the short, thick, weakly elevated disto-lateral carinae, the small apical portion triangular with apex bluntly rounded. Surface of supra-anal plate broadly concave laterad, with a broad medio-longitudinal sulcus in proximal half, which is very weak (absent in paratype) in distal half.

Cerci nearly two and one-half times as long as basal width, straight, narrowing gradually, then expanding, so that the distal third is slightly enlarged with dorsal margin slightly more convex than ventral margin, apical portion with external surface weakly concave, broadly rounded dorso-distad, but forming a moderately (sharply, in paratype) rounded rectangulate disto-ventral angle, the distal margin transverse. Subgenital plate produced meso-dorsad in a large, bluntly rounded tubercle, directed caudad, which tubercle is slightly more produced and less heavy than in *femur-nigrum*.

*Allotype*.— ♀ ; same data as type. [Acad. Nat. Sci. Phila.]

Agrees with type except as follows. Size larger, form more robust. Sulcation of vertex and frontal costa weaker and broader. Eye about one and two-thirds times as long as infra-ocular sulcus. Pronotum with lateral margins of disk weakly divergent to principal sulcus. Prosternal spine heavier toward its base. Ovipositor valves moderately elongate, with distal curvature rather broad; the dorsal valves with dorsal surface and margins proximad rather well supplied with serrations.

*Measurements (in millimeters)*

| ♂ | Length of body | Length of pronotum | Caudal width of pronotal disk | Length of tegmen | Width of tegmen | Length of caudal femur |
|---|---|---|---|---|---|---|
| *Type* | 20.2 | 4.7 | 2.8 | 5 | 2.8 | 10.8 |
| *Paratype* | 19[15] | 4.6 | 2.7 | 4.9 | 2.6 | 10.7 |
| ♀ | | | | | | |
| *Allotype* | 24 | 5.3 | 3.9 | 5.9 | 3.4 | 12.7 |

Dorsal surface of male blackish chestnut-brown; the lateral margins of the pronotal disk outlined in buffy to the principal sulcus in the paratype (a frequent color feature in species of this group). Other portions of head, ventral portions of pronotal lateral lobes, cephalic and median limbs and underparts clay color, often with an olivaceous tinge; the head with a broad shining postocular black bar, which broadens and is continued on the lateral lobes of the principal sulcus. Lateral portions of thorax blackish, with a striking, oblique bar of light buff. Sides of abdomen heavily overlaid with shining black, this narrowing strongly caudad.

[15] Estimated, the abdomen being curved upward in this specimen.

Dorsal surface of caudal femora hazel, with all of geniculai areas, two bars and a proximal fleck of chestnut-brown, the first bar extending a brief distance on the internal surface, the second bar crossing the internal surface, which is elsewhere buff-yellow, becoming paler before the geniculai area. External surface of caudal femora colored as is characteristic of the group; chestnut-brown, with the rather narrow ventral portion buff-yellow; ventral surface faintly tinged with orange. Caudal tibiae rich glaucous-blue, spines black, spurs white proximad and black distad.

The female is very similarly colored, the dorsal surface being paler, chestnut-brown.

In addition to the type and allotype, a single paratypic male, bearing the same data, has been examined.

**Melanoplus fultoni**[16] new species (Plate III, figs. 11 and 12.)

This diminutive species is a member of the Marginatus Group, belonging to that section which includes the forms very closely allied to *M. gracilipes* Scudder.

It is nearest *M. sonomaensis* Caudell, differing in the male sex in the proportionately longer and more slender furcula, supra-anal plate with transverse median carina (subobsolete in *sonomaensis*) raised in a small but prominent rounded lamella on each side of the medio-longitudinal sulcus, and subgenital plate which rounds evenly to the blunt apex (where, in *sonomaensis*, there is a small but conspicuous subapical tubercle).

In the female sex these species are almost inseparable. The females of *fultoni* before us differ from those of *sonomaensis* only in being slightly more robust, with fastigium of vertex a trifle less protuberant. The females of the other closely related species of this group are likewise almost indistinguishable. The difficulty in the present case is aggravated by the fact that we have *sonomaensis*, not only from north and south of Lagunitas, California, but from that locality as well.

*Type.*—♂; Lagunitas, Marin County, California. August 7, 1921. (B. B. Fulton.) [Hebard Collection, Type no. 832.]

Size small, form slender; agreeing closely with *sonomaensis*. Head much as in that species. Eye distinctly more than twice as long as infra-ocular sulcus. Pronotum as in *sonomaensis* and other closely related species; elongate, disk of almost equal width throughout, median carina well defined and percurrent; caudal margin broadly obtuse-angulate produced. Prosternal spine conical with apex moderately blunt (varying from blunt to a condition in which the

[16] Named in honor of the collector of this insect, Mr. B. B. Fulton, whose masterly "Tree Crickets of New York" is one of the finest of recent entomological contributions.

spine is more slender with apex much more sharply rounded in the paratypes). Tegmina considerably shorter than pronotum, almost attingent, with apex broadly rounded.

Furcula represented by a pair of minute, slender processes, three times as long as broad, which do not taper to their rounded apices (varying to more slender and weakly tapering in the paratypes), are faintly divergent (varying to moderately divergent in the paratypes), with length contained in that of supra-anal plate nearly four times (varying to three and one-half times in the paratypes). Supra-anal plate moderately elongate, shield-shaped; median sulcus decided, with lateral margins distinctly carinate to slightly beyond median point; transverse carina there, toward the lateral margins of this sulcus, developed into a small but conspicuous lamella on each side, with margin rounded; lateral portions of plate rather strongly concave, disto-lateral carinae subobsolete.

Cerci faintly bent slightly beyond end of proximal two-thirds, approximately twice as long as basal width, tapering strongly proximad; dorsal margin broadly concave, ventral margin straight, becoming weakly convex distad; distal portion very slender to the rather sharply rounded apex, the external surface showing faint subapical concavity. Subgenital plate with median section of equal depth laterad and mesad, curving and tapering meso-distad to the blunt apex, which shows no trace of tuberculation. Limbs as in *sonomaensis*.

*Allotype*.—♀; same data as type. [Hebard Collection.]

Size larger, form heavier, fastigium of vertex broader and less deeply sulcate than in male. Compared with females of *sonomaensis* above.

*Measurements (in millimeters)*

| ♂ | Length of body | Length of pronotum | Caudal width pronotum | Length of tegmen | Width of tegmen | Length of caudal femur |
|---|---|---|---|---|---|---|
| *Type* | 13 | 3.3 | 1.9 | 2.7 | 1.9 | 8 |
| *Paratypes*, (6) | 13–14.7 | 3.3–3.4 | 1.9–2 | 2.1–3.2 | 1.3–2.2 | 7.9–8.5 |
| ♀ | | | | | | |
| *Allotype* | 18.8 | 4 | 3.1 | 4 | 2.7 | 10.1 |
| *Paratypes*, (2) | 17.7–18 | 4–3.9 | 3–2.9 | 3.6–4 | 2.7–2.7 | 10–10.1 |

Head tawny-olive, except occiput which is verona brown and a broad, shining, sharply defined, postocular bar of blackish brown. Eyes cinnamon-brown tinged with tawny. Antennae tawny-olive proximad, russet in other portions. Pronotum with disk verona brown, lateral lobes with a band of shining blackish brown occupying dorsal two-fifths of prozonal portion, corresponding metazonal portion verona brown deepening to warm sepia in dorsal portion, lower portion of lateral lobes tawny-olive. Tegmina verona brown, somewhat darker ventrad. Abdomen cinnamon dorsad, cinnamon-buff ventrad, with a broad band of shining blackish brown on each side, which

narrows and decreases into small flecks on the distal tergites. Other portions of ventral surface clay color. Cephalic and median limbs clay color, tinged with cinnamon. Caudal femora similar, but showing faintly the characteristic Melanoploid pattern in a slightly darker brown, ventral surface orange-cinnamon. Caudal tibiae weak grayish glaucous; external spines black, internal spines and all spurs whitish proximad, black distad.

In the intensive examples the markings of the caudal femora are more distinct, the ventral surfaces brick red. In one female the caudal tibiae are grayish, showing no trace of glaucous. Another female is pale greenish yellow, showing no darker markings.

In addition to the described pair, a paratypic series of six males and two females is before us, belonging to the Fulton and Hebard Collections.

## EXPLANATION OF PLATES

### Plate II

Fig. 1.—*Agroecotettix modestus aristus* new subspecies. Uvalde, Texas. Male (*type*). Lateral view. (×2½)

Fig. 2.—*Agroecotettix modestus aristus* new subspecies. Uvalde, Texas. Male (*type*). Lateral view of cereus. (Greatly enlarged.)

Fig. 3.—*Agroecotettix modestus aristus* new subspecies. Uvalde, Texas. Female (*allotype*). Lateral view. (×2⅗)

Fig. 4.—*Agroecotettix modestus crypsidomus* new subspecies. Marathon, Texas. Male (*type*). Lateral view. (×2½)

Fig. 5.—*Agroecotettix modestus crypsidomus* new subspecies. Marathon, Texas. Male (*type*). Lateral view of cereus.[17] (Same scale as fig. 2.)

Fig. 6.—*Agroecotettix modestus crypsidomus* new subspecies. Marathon, Texas. Female, (*allotype*). Lateral view. (×2⅗)

### Plate III

Fig. 1.—*Conalcaea coyoterae* new species. Prescott, Arizona. Male (*type*). Lateral view of cereus. (Greatly enlarged.)

Fig. 2.—*Conalcaea coyoterae* new species. Prescott, Arizona. Female (*allotype*). Lateral view of caudal femur. (×2¼)

Fig. 3.—*Conalcaea coyoterae* new species. Prescott, Arizona. Female (*allotype*). Lateral view of dorsal ovipositor valve. (Greatly enlarged.)

[17] Due to the fact that the internal section of the distal portion of the cereus is of necessity foreshortened in this aspect, it appears as long as the external section, but is in reality very slightly shorter.

Fig. 4.—*Conalcaca huachucana* Rehn. Carr Canyon, Huachuca Mountains, Arizona. Male (*type*). Lateral view of cercus. (Same scale as fig. 1.)

Fig. 5.—*Conalcaca huachucana* Rehn. Carr Canyon, Huachuca Mountains, Arizona. Female (*allotype*). Lateral view of caudal femur. (×2¼)

Fig. 6.—*Bradynotes chilcotinae* new species. Riske Creek, Chilcotin, British Columbia. Male (*type*). Dorsal view of furcula and supra-anal plate. (Greatly enlarged.)

Fig. 7.—*Bradynotes chilcotinae* new species. Riske Creek, Chilcotin, British Columbia. Male (*paratype*). Dorsal view of distal portion of supra-anal plate, showing variation in the species. (Same scale as fig. 6.)

Fig. 8.—*Bradynotes chilcotinae* new species. Riske Creek, Chilcotin, British Columbia. Male (*type*). Lateral view of cercus. (Greatly enlarged.)

Fig. 9.—*Melanoplus chiricahuae* new species. Ida's Peak, Chiricahua Mountains, Arizona. Male (*type*). Dorsal view of furcula and supra-anal plate. (Scale same as fig. 6.)

Fig. 10.—*Melanoplus chiricahuae* new species. Ida's Peak, Chiricahua Mountains, Arizona. Male (*type*). Lateral view of cercus. (Scale same as fig. 8.)

Fig. 11.—*Melanoplus fultoni* new species. Lagunitas, California. Male (*type*). Dorsal view of furcula and supra-anal plate. (Same scale as fig. 6.)

Fig. 12.—*Melanoplus fultoni* new species. Lagunitas, California. Male (*type*.) Lateral view of cercus. (Same scale as fig. 8.)

# NEW SPECIES OF COLEOPTERA OF THE TRIBE CLERINI, WITH NOTES ON OTHERS

BY A. B. WOLCOTT

*Chicago, Illinois*

The primary intention of the writer was to give in this paper merely the description of a recently acquired and very interesting species of *Enoclerus*. In looking over the material in my collection, however, a few other non-descripts came to my notice and, as most of these have been in my possession for many years, it was thought advisable to make them known now. To these descriptions I have added notes on some known species.

**Placopterus subcostatus** Schaeffer

*Clerus thoracicus* var. *subcostatus* Schaeffer, Journ. N. Y. Ent. Soc., xxv, p. 131, 1917.

This form was described as a variety of *thoracicus* Olivier, and placed by me (in Leng's Catalogue of Coleoptera) as a variety of *cyanipennis* Klug. Renewed study of my material shows beyond a doubt that I was in error in placing this as a variety of *cyanipennis*, as *subcostatus* is entirely distinct, not alone by the longer, less broadly rounded prothorax, but also by the color of the decumbent pubescence, which in *subcostatus* is dark brown (nearly black in one specimen from Marion County, Florida). In *cyanipennis* the decumbent pubescence is grayish-white, although the erect hairs are black, just as they are in *P. thoracicus*.

I am unwilling to believe that the color of the vestiture and the sculpture of the elytra are of less than specific importance, and hence must regard *subcostatus* as a valid and distinct species.

Our few species of *Placopterus* may be separated by means of the following table:

Decumbent pubescence of elytra brown or black. . . . . **subcostatus** Schaeffer
Decumbent pubescence of elytra whitish or grayish.
  Prothorax short, sides broadly and evenly rounded to near the base.
    Prothorax reddish, the posterior margin narrowly, the anterior margin broadly, blue, elytra dark blue. . . . . **cyanipennis** Klug

Prothorax red with anterior margin black, varying to entirely black, elytra dark green with metallic reflections.
**cyanipennis** var. **dasytoides** Westwood

Prothorax longer, sides evidently constricted near apex.
Elytra dark blue or black.
Legs black.....**thoracicus** Olivier
Legs pale yellowish.....**thoracicus** var. **pallipes** Wolcott

**Enoclerus erro** new species

Form similar to *E. lecontei* Wolcott (*nigriventris* Leconte, preoccupied), but more robust and more depressed. Black, slightly aeneous, shining, apical and basal thoracic margins (the former broadly, the latter narrowly), basal fourth of elytra and trochanters rufo-castaneous. Head sparsely, finely punctate, more densely so toward the eyes and on occiput, densely clothed with recumbent and erect long, very coarse white hairs, a few rather long black hairs on occiput. Prothorax finely, rugosely punctate, pubescence as in *lecontei*. Elytra finely subgranulose, very finely and densely punctate, basal region nearly smooth, with a small number of large, shallow, scattered punctures, showing no tendency to become lineal in arrangement excepting a few which form a feeble subsutural row, basal fourth and apical third clothed with coarse whitish pubescence, the entire surface with erect and semi-erect sparse black hairs. Metasternum alutaceous, minutely, very sparsely punctate, with a few feebly impressed large punctures. Abdomen more densely and coarsely punctate than in *lecontei*. Length, 6.2 mm.

Santa Rita Mountains, Arizona, 5,000–8,000 feet, July. (F. H. Snow.) *Holotype*, a female (No. 121), in my collection.

Allied to *lecontei* but differing from that species by the wider head and prothorax, the broader and more depressed form and the more sparsely and less uniformly punctate head. The median angulated band of whitish pubescence seen in *lecontei* is here entirely wanting, and the whole of the basal fourth of the elytra (excepting the two large, obtuse basal tubercles) is rather densely clothed with whitish hairs, whereas in *lecontei* there is a band of these hairs at about basal fourth and the suture from this band to the base is also clothed with similar hairs.

**Enoclerus longissimus** new species

Elongate, slender, moderately convex, shining, black, mandibles, antennae, front tibiae and all the tarsi rufo-piceous; sparsely clothed with erect and semi-erect black hairs with a few gray recumbent hairs intermixed; elytra with an antemedian fascia of grayish-white hairs. Head, including the eyes, subequal in width to the prothorax, minutely, remotely punctate. Prothorax as long as wide, minutely, sparsely punctate. Elytra one-third wider than the prothorax, two and two-thirds as long as wide at base, sides subparallel, very slightly broader at apical third, thence arcuate to apex, the apices separately

rounded, surface punctured as in *ocreatus* Horn, but with four subsutural striae at middle on each elytron, basal tubercles feebly developed, post-scutellar depression feeble. Abdomen finely, remotely punctate, closer and coarser at the sides. Length, 6.5 mm.

New Mexico. (John D. Sherman, Jr.) *Holotype*, a female (No. 167), in my collection.

Allied to *E. ocreatus* Horn, but the form is much more slender, the sculpture of the elytra and abdomen finer and the elytral apices with the conspicuous gray hairs of that species wanting.

**Enoclerus lautus** new species

Elongate, shining, head, prothorax, basal fifth of elytra, trochanters, tibiae and tarsi rufous; the head with a broad black maculation starting on middle of front and furcate upon occiput; thorax with two large rounded black discal maculations, a smaller one each side on the flanks, these all narrowly connected; elytra with a transverse median fascia, arcuate upon each elytron, composed of white pubescence, the rufous basal portion bordered posteriorly and the apical fifth clothed with white pubescence, vestiture elsewhere composed principally of long erect black hairs. Head, including the eyes, slightly narrower than prothorax at widest part, rather evenly and closely punctate, front with two well developed longitudinal impressions; antennae red, mandibles black. Prothorax very slightly longer than wide, more finely and sparsely punctate than the head. Elytra one-fourth wider than prothorax, sides feebly divergent from basal sixth to apical fifth, apices separately rounded, post-scutellar region feebly depressed, surface rugulose, finely punctate, coarsely, sparsely so at base. Posterior margin of abdominal segments pale yellow. Length, 5.5 mm.

Santa Rita Mountains, Arizona, 5,000–8,000 feet, June. (F. H. Snow.) *Holotype*, a female (No. 882), in my collection.

The relationship of this species to the other members of the genus is difficult to indicate; it is perhaps best placed in proximity to *E. pinus* Schaeffer.

The species of *Enoclerus* allied to *nigrifrons* Say and *nigripes* Say appear to be about the most misunderstood, and in collections the most confused, species of this rather extensive genus. The following table is offered as an aid to their recognition:

A. Elyta black with one or two, usually interrupted, whitish fasciae; moderately robust.

a. Head and prothorax red, abdomen black, legs brown.

**quadriguttatus** Olivier

aa. Head and prothorax black, abdomen red, legs black.

**nigripes** var. **rufiventris** Spinola

B. Elytra black, the humeri red, fasciate as in secton A, very robust. Head, prothorax, venter, abdomen and legs black.....**gerhardi** new species

C. Elytra black, the basal third or more red, fasciate as in section A.

b. Shining; head and prothorax red, the occiput and front of the former usually black, the prothorax usually with a large discal black maculation, but varying from head and prothorax entirely red to the same parts entirely black.

c. Rather slender, legs and ventral surface entirely black. **nigrifrons** Say

cc. More robust, sutural margin of elytra from base to apical third, coxae and legs pale testaceous. **nigrifrons** var. **testaceipes** new variety

bb. Feebly shining; head and prothorax usually red, sometimes in part or entirely black, the legs black, abdomen red.

c. Elytra red in nearly basal half, front of head immaculate. **nigripes** Say

cc. Elytra red in basal third only, front of head with a more or less developed black maculation.....**nigripes** var. **dubius** Spinola

**Enoclerus quadriguttatus** Olivier

*Clerus quadriguttatus* Olivier, Entomologie, IV, genus 76, no. 23, p. 18, pl. 2, figs., 23, a, b, 1795.

No species of *Enoclerus* found in the United States, so far as known to the writer, can be referred to the present species, the original description of which follows:

"23. Clairon quatre-taches.

*Clerus quadriguttatus.* Pl. 2. fig. 23. *a. b.*

C. noir; tête et corcelet fauves; elytres avec quatre taches blanches.

C. Niger, capite thoraceque rufis, élytris maculis quatuor albis.

Parvus. Antennae fuscae. Caput rufum oculis nigris. Thorax rufus pubescens. Elytra punctata nigra, fasciis duabus interruptis albis. Corpu nigrum. Pedes fusci.

Il est petit, les antennes sont brunes. La tête est fauve, avec les yexu noirs. Le corcelet est fauve, pubescent. Les élytres sont ponctuées, noiress avec deux bandes blanches, interrompues, qui paroissent former quatre taches, deux sur chaque élytre. Le dessous du corps est noir, avec les pattes brunes.

Il se trouve dans la Caroline.

Du Cabinet du cit. Bose."

The figures cited by the author of this species are colored and agree perfectly with the description, as far as it goes, both as regards color and markings. One of the figures represents the insect much enlarged, the other intended to indicate the natural size is exactly five millimeters in length, thus agreeing in size and in general form with *nigripes* Say. The prothorax is, however, represented as being much more elongate than in *nigripes* and

its allies. *Quadriguttatus*, as shown, has the elytral maculations of a different type from its supposed allies: in *nigripes*, and its varieties, *rufiventris* and *dubius*, as well as in *nigrifrons* and almost imperceptibly in *gerhardi*, the basal maculations trend obliquely forward from near the lateral margins of the elytra to near the middle of each elytron, they are also more remote from base of elytra being at or but slightly before the middle of their length, while in *quadriguttatus* the basal maculations are confined entirely within the limits of the basal third of the elytra, and the trend of these is obliquely backward from near the side margin to near the suture; the subapical spots are somewhat triangular in form.

The writer has examined many hundred specimens of *nigripes* and allied forms without finding anything that could be considered as being Olivier's species. Special appeals to quite a few of our most enthusiastic and diligent collectors have utterly failed to bring to light this coveted species.

It is inexplicable that this species, so distinctively colored and strikingly marked, should have been allowed for such a long period of time to stand unchallenged as a member of our fauna, and especially so in view of the fact that Dr. John L. Leconte as long ago as 1849[1] placed this species under the caption "Species dubiae, an hujus patriae", both *nigripes* and *nigrifrons* having been rather fully described in the preceding pages. Nearly all subsequent writers seem to have been reluctant to take this view and as a result imposed the name upon an entirely distinct species. The occurrence of *E. quadriguttatus* within our faunal limits is so extremely doubtful that, in the writer's opinion, it would be better removed from our lists.

**Enoclerus nigripes** Say

*Clerus nigripes* Say, Journ. Acad. Nat. Sci. Phila., III, p. 191, 1823.

*Clerus incertus* Lec., Smiths. Misc. Coll., VI, p. 55, 1863.

*Clerus quadriguttatus* Auctt., nec Olivier, Leconte, Schenkling.

This is the species that has been wrongly identified by nearly all writers as *E. quadrigattatus* Olivier. It is, however, very distinct from that species, as it also is from *nigrifrons* Say. In the last mentioned species the abdomen is always black, red in *nigripes*. *E. nigrifrons* is a more slender species in which the upper surface is more finely sculptured and decidedly shining

[1] Ann. Lyc. Nat. Hist. N. Y., V, p. 25 (p. 17 of separates).

Dr. Geo. H. Horn[2] in the space of a single sentence sinks both *nigrifrons* and *nigripes* as synonyms of *quadriguttatus* Olivier, but Sigmund Schenkling[3] with whom the writer agrees, regards *quadriguttatus* Olivier as an unknown species.

**Enoclerus nigrifrons** variety **testaceipes** new variety

Differs from the typical form as follows: Less robust; elytral surface more roughly sculptured, basal tubercles much less developed, surface more depressed; the median fascia broader, its margins straight and parallel, not at all oblique, broadly interrupted at the suture; sutural margin from base to apical third pale testaceous. Legs pale testaceous. Color otherwise as in typical form. Length, 5.5 mm.

Miller, Indiana, June 27, 1915. (Wm. J. Gerhard.) *Holotype*, a male (No. 886), in my collection.

**Enoclerus gerhardi** new species

Similar in general form to *nigripes* Say. Black; two basal joints of antennae, mandibles (except apices), and the elytral humeri rufous; shining; moderately pubescent throughout. Head finely punctate, front with the nearly smooth and somewhat elevated area (evident in *nigripes*) wanting. Prothorax minutely and very sparsely punctate, more coarsely and densely so at sides and apex; sides feebly rounded, moderately constricted subapically, nearly straight and convergent toward base, the latter narrow. Elytra distinctly granulate-punctate, ante-median fascia and sub-apical maculations white, densely clothed with white pubescence, the fascia trending but slightly obliquely forward from extreme elytral margin to about one-third from suture, thence turning abruptly and obliquely backward to near the suture. Metasternum nearly smooth at middle, very minutely punctate at sides. Abdomen rather finely punctate. Length, 5.2 mm.

Miller, Indiana, July 18, 1915. *Holotype*, a male (No. 880), in my collection. Collected and presented to me by my friend Mr. Wm. J. Gerhard, to whom I dedicate this charming little species, as a slight token of appreciation of the numberless favors he has shown me.

Nearest allied to *nigripes* Say, but differing from that species in having the head more finely punctate, the sides of prothorax less rounded and more nearly straight and oblique toward base, the base narrower, the elytra less roughly sculptured and the abdomen a little more finely punctate.

[2] Trans. Amer. Ent. Soc., XII, p. 154, 1885.
[3] Deutsche Entomol. Zeitschrift, p. 273, 1906.

**Enoclerus liljebladi** new species

Similar in form and general appearance to *E. ichneumoneus* Fabricius, from which it differs as follows: Head entirely red (the mandibles, palpi and antennae excepted), more finely and sparsely punctate. Prothorax with disc more finely punctate, the sides less strongly rounded, the subapical constriction stronger, the transverse impression much less sinuate. Scutellum subtransverse, obtusely rounded at apex (elongate triangular in *ichneumoneus*). Elytra black at base, basal fourth transversely rugulose and very finely punctate (coarsely and deeply punctate in *ichneumoneus*). Abdomen more punctate, intercoxal portion of first abdominal segment non-carinate, somewhat tumid near apex. Length, 7.5 to 12 mm.

With the form and color nearly as in *ichneumoneus*, this insect is upon examination found to possess but few characters in common with that species. Fifteen specimens have been seen and all agree among themselves in possessing the characters given above. This species also bears some resemblance to *muttkowskii*, but that species is broader, more depressed and the scutellum is orbicular. In *liljebladi* the anterior margin of the mesosternum is prominently lobed at middle, its anterior face nearly vertical and almost smooth, the submarginal carinae obsolescent at middle (this condition produced by the coarse strigose sculpture): in *muttkowskii* the lobe is feeble, broad, its anterior face arcuately descending, the outer margin finely carinate: in *ichneumoneus* the lobe is broad but rather prominent, its anterior face vertical, the lobe with a large, deep, irregularly hexagonal, depressed area, the margin of which is strongly carinate; the submarginal carinae are strongly developed and confluent with the carinate margin of depressed area near the middle of the sides. Many other differences are observable, but the above are amply sufficient to differentiate this particularly interesting species, the discovery of which is due to the assiduous collecting of my life-long friend, Mr. Emil Liljeblad, by whom it was taken on dead pine trees.

Pentwater, Michigan, July 11 to 22, 1920. *Holotype*, a male (No. 1203); *allotype*, a female (No. 1204); *paratype*, a male; *paratype*, a female, in the collection of the American Entomological Society. Paratypes are also in the collection of Mr. Liljeblad and that of Dr. Edward A. Chapin, of Washington, D. C.

The males average much smaller than the females, one very large male attains a length of 10.5 mm. In the male the last

ventral segment is broadly arcuate-emarginate, red: in the female the same segment is broadly and obtusely rounded, nearly truncate at apex, and more or less piceous or black.

**Enoclerus opifex** Gorham

*Clerus opifex* Gorham, Biol. Centr.-Amer., Col., III, p. 156, pl. VIII, f. 3, 1882.

This Central American species has been recorded as occurring in our fauna but once; in 1911[1] the writer recorded this species as taken at Alpine, Texas. No further representatives have been seen by me, but Mr. Chas. Liebeck has informed me that a specimen of this species is in the collection of the Academy of Natural Sciences, Philadelphia, which was taken by Messrs. Hebard and Rehn at Alamogordo, New Mexico, July 1907.

**Enoclerus chapini** new species

Moderately robust; feebly shining; red, occiput of head piceous, metasternum and elytra black, the latter with the lateral margin from base to apex, the elevated sutural margin, apical fourth, base somewhat narrowly at the humeri but more broadly in scutellar region, red, a curved median fascia and a small maculation at base, pale yellow; ventral abdominal segments red, their posterior margins (except fifth and sixth), black; pubescence moderately dense, the long pale hairs most evident at prothoracic flanks, base and apical fourth of elytra. Head (including the eyes) distinctly narrower than prothorax at widest part, finely but not very closely punctate. Prothorax as long as wide, apex one-third wider than base, subapical constriction and transverse impressed line very nearly obsolete, ante-basal constriction and the sub-basal transverse impressed line distinct; sides very feebly rounded, widest near base, strongly narrowing to about basal fourth, thence parallel to base; finely and very sparsely punctate, more densely so at the sides. Elytra moderately depressed; sides straight, nearly parallel to apical third, thence broadly and evenly rounded to the suture, the apices being conjointly rounded; very coarsely, closely punctate, especially in basal half of the elytra, at apex less coarsely and more shallowly punctate, in about the anterior two-thirds the punctures are somewhat distinctly seriate, three rather feeble costae being present upon each elytron. Length, 4.8 mm.

Arizona, (Morrison). *Holotype*, a male (No. 509) in my collection.

Named in honor of Dr. Edward A. Chapin, who has contributed greatly to our knowledge of this family.

The specimen upon which this species is founded bears a slight resemblance to *E. laetus* var. *obruptus* Leconte, and has for many years been placed with that species in my cabinet,

[1] Ent. News, XXII, p. 120.

but never in a satisfactory way. The coarse sculpture of the basal portion of elytra will immediately separate it from the allied *laetus* and its variety *abruptus*. It is, however, more closely related to *atriceps* Gorham, of Guatemala. In *atriceps* the head may be either black or red, it is also a larger species (7.3 mm.) than *chapini*, the color pattern is, however, quite similar, the principal difference being that in *chapini* the median fascia forms a distinct curve upon each elytron, the convexity toward the base, in *atriceps* the fascia is straight, the pale yellowish basal maculation wanting, and the apical margin of the prothorax narrowly black, the head is somewhat more coarsely and deeply punctate than in *chapini* but the elytral sculpture is quite similar in the two species.

**Enoclerus laetus** Klug and **Enoclerus coccineus** Schenkling

*Clerus laetus* Klug, Abh. Berl., Akad., p. 301, 1842.
*Clerus abruptus* Leconte, Proc. Acad. Nat. Sci. Phila., p. 72, 1858.
*Clerus coccineus* Schenkling., Deutsch. Ent. Zeit., p. 272, 1906.
*Clerus corallinus* Fall, Trans. Amer. Ent. Soc., XXXIII, p. 240, 1907.

Under the name *Clerus corallinus* Fall, Mr. Chas. Schaeffer[5] has published a note in which he places *corallinus* as a variety of *abruptus* Leconte, failing to appreciate the fact that *abruptus* is but a variety of *laetus*, the latter name having priority; also that Prof. Fall's species is a synonym of *coccineus* Schenkling. Schaeffer also alludes to the probability of *flavosignatus* Spinola, *recurvatus* Gorham, and *laetus* Klug being merely variations of *abruptus*.

The writer feels compelled to dissent from the expressed opinion of Mr. Schaeffer so far at least as it relates to the identity of *laetus* and *coccineus*. It is the author's firm conviction that we have here two distinct species, and while it may be true that we have little more than type of color pattern to enable separation of these species, this appears to me to be, in this genus, of equal value to other specific characters. There is, in my opinion, always a distinct line of demarcation existent in the type of pattern in these two species. In all the specimens having a

[5] Journ. N. Y. Ent. Soc. XVI, p. 131, 1908.

rather narrow, more or less lunate median fascia which it has been my privilege to examine, the fascia is distinctly interrupted at the suture, and these are referable to *laetus* and its variety *abruptus*. In *coccineus* the medium fascia is very broad, occupying one-third or more of the length of the elytra and is distinctly wider at the elytral margin and at the suture, where instead of being interrupted it extends along the sutural bead for a short distance toward the apex, and also extends along the suture from the fascia usually quite to the scutellum; the form is a trifle more slender and the elytral sculpture finer than in *laetus* or *abruptus*.

Mr. Schaeffer seems to have been influenced primarily by the fact that the two species in question, and also those mentioned by him as very likely varieties, have at base an identical maculation. It would be entirely unsafe to assume that the presence of these maculations denoted specific identity; as an illustration, there are numerous species, mostly South and Central American, possessing this basal fleck or spot, in which the type of elytral pattern is so distinctive that even the most conservative of students must regard them as specifically distinguishable.

The writer believes that the species possessing this basal maculation, which is almost invariably a paler color than the surrounding color and usually more shining and smoother than the rest of the surface, situated at the base of each elytron, and a little closer to the scutellum than the humeri, form a natural group. The origin of this maculation may be perhaps traced to those species having a basal striga, that is, a slightly elevated elongate narrow whitish spot or line at base, such as is seen in the Brazilian *scenicus* Klug, from which we may pass to such types as *mysticus* Klug, in which the basal half of elytra is yellow with dark markings, leaving the location of the maculation (and more) pale. Thence we pass on to *ruficollis* Castelnau, in which the elytra are dark at base with a pale marking starting from the position of the usual maculation, running obliquely to near the suture which it parallels to just in front of the middle, thence turning forward to the marginal flanks at a point just behind the humeri. By successive steps we then proceed through such species as *artifex* Spinola, *pulchellus* Klug, *sobrinus* Castelnau, *deliciolus* Gorham, *pusillus* Klug, *distinctus* Spinola, *bilobus* Spinola, *recurvatus* Gorham, *flavosignatus* Spinola, and *atriceps*

Gorham, to those of our own limited fauna, that is *chapini*, *laetus* and its variety *abruptus* and finally reach *coccineus*.

**Enoclerus palmii** Schaeffer

*Clerus palmii* Schaeffer, Journ. N. Y. Ent. Soc., XII, p. 218, 1904.

This species, described from one specimen, was known from Arizona (Senator), only. It is known to me from Las Vegas and Gallup, New Mexico, and just recently Mr. Warren Knaus sent me for determination a series of four specimens bearing labels reading as follows:—"Coal Creek Canon, Cedar City, Utah, 6500 ft. July 25, '21. Knaus, Nininger, Hoover." This series is remarkably uniform in size, form, color and pattern of elytral fascia.

**Serriger reichei** Spinola

*Serriger reichei* Spinola, Mon. Clerites, p. 171, pl. XII, fig. 3, 1844.
*Aulicus antennatus* Schaeffer, Proc. U. S. Nat. Mus., LIX, p. 158, 1921.

If the writer has correctly identified Mr. Schaeffer's species, it is the same as *Serriger reichei*, a genus and species which from the time of the appearance of the original description seem to have remained unknown to all writers, including the great savant Lacordaire, Although it was described from Reiche's collection as from "Le Mexique," it was entirely unknown to the Rev. H. S. Gorham, author of that portion of the Biologia Centrali-Americana which deals with the family Cleridae, but he remarks that *Serriger* is a genus about which there is room for a good deal of doubt. In 1917, in rearranging a portion of my Clerid material, this species was recognized by me, mixed amongst some *Aulicus* species, where it had been placed without proper study being given to it. The specimen at hand is a male from "So. Cal." The form, color and color pattern, sculpture and size agree so well with Spinola's description and figure that the present specimen might be said to fit perfectly in every detail. There is, however, a slight difference in the structure of the antennae; the fifth joint, in the detail drawing accompanying the figure, is represented as rather strongly dilated, in my specimen it is scarcely discernibly dilated. It is a well established fact that quite a few of the detail figures given in the "Monographie" are more or less inaccurate, sometimes even as to the number

of joints shown. My specimen agrees so well with the description of *Aulicus antennatus* that I feel sure that we have the same species in hand. It was upon the record afforded by the specimen in my collection that the writer entered this as a member of our fauna in Leng's Catalogue of Coleoptera.

# THE GENUS XIPHANDRIUM LOEW IN NORTH AMERICA

## (DIPTERA; DOLICHOPODIDAE)

BY M. C. VAN DUZEE

*Buffalo, New York*

In 1899, Dr. Wheeler described as *Porphyrops xipheres*, a typical species of the genus *Xiphandrium*, although hitherto it has never been placed therein. This is the only described species of the genus from North America. Having five new species and a variety in my collection, I am describing these; no doubt others have unrecognized material in this interesting little genus.

I have taken them only by sweeping in rather swampy, sunny places where there was short grass.

They resemble small *Porphyrops*, being from 2.5 to 3.5 mm. in length, with long strap-like third antennal joints, usually from six to ten times as long as wide; the arista is terminal, rather thick and short, usually about as long as the width of the front; the middle coxae usually have a spine or thorn at tip as in many of the *Porphyrops*, these spines are often pale in color. The wings are much like those of *Porphyrops*, except that they are narrower, especially at base. When once recognized the genus is easily distinguished from the related genera.

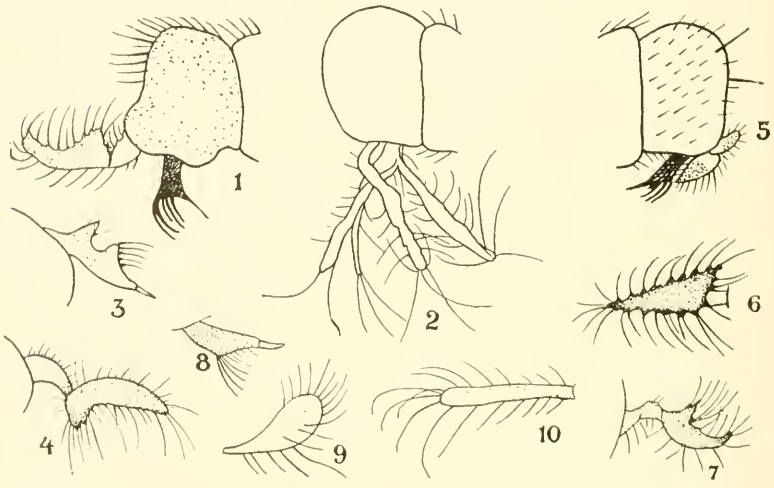
### *Table of North American Species, Males*

1. All coxae yellow ..... 2
   At least middle and hind coxae blackened at base for half their length ..... 1
2. Hind femora wholly yellow; hind tibiae brownish yellow, darker apically. (Georgia) ..... **flavicoxa** new species
   Tips of hind femora and the whole of their tibiae and tarsi black ..... 3
3. Outer lamellae short; hypopygium as in figure 5. (New York.) **femineum** new species
   Outer lamellae rather long as in figure 7. (New York.) **femineum** var. **dubium** new variety
4. Third antennal joint nearly, or even more than, twice as long as the height of the head ..... 5
   Third antennal joint about as long as the height of the head ..... 6
5. Outer hypopygial appendages filiform, as in figure 2. (Colorado.) **longicorne** new species
   Outer hypopygial appendages lamellae-like, as in figure 9. (Alaska.) **aldrichi** new species

6. Hind femora and their tibiae almost wholly yellow; outer hypopygial lamellae as in figure 6. (Arizona.)..... **triangulatum** new species
Hind femora black at tip; hind tibiae wholly deep black..... 7

7. Inner hypopygial appendages club-shaped. (Pennsylvania.)
**xipheres** Wheeler
Inner appendages more shovel-shaped (about as in figures 3 and 8)..... 8

8. Inner hypopygial appendages (figure 3) with a horn-like protuberance near the middle of their length. (Nevada, Oregon, Alaska.)
**femoratum** var. **pollex** new variety
Inner appendages without such a protuberance; hypopygium as in figure 1, (Nevada, Alaska.)..... **femoratum** new species




*Explanation of figures of Xiphandrium*

Fig. 1, *femoratum* new species, hypopygium of male. Fig. 2, *longicorne* new species, hypopygium of male. Fig. 3, *femoratum* variety *pollex* new variety, inner appendages of the hypopygium of male. Fig. 4, *femoratum* new species, outer lamella of the hypopygium of male. Fig. 5, *femineum* new species, hypopygium of male. Fig. 6, *triangulatum* new species, outer hypopygial lamella of male. Fig. 7, *femineum* variety *dubium* new variety, outer hypopygial lamella of male. Fig. 8, *femineum* variety *dubium* new variety, inner appendages of the hypopygium of male. Figs. 9 and 10, *aldrichi* new species, appendages of the male hypopygium.

**Xiphandrium xipheres** Wheeler

*Porphyrops xipheres* Wheeler, Proc. Cal. Acad. Sci., II, p. 34, pl. II, fig. 53.

The following is a copy of Prof. Wheeler's description; I have not seen any specimen of this form.

♂: Length, 3.5 mm.; of wing, 3 mm. Palpi small, dusted with white. Face broad for a male, covered with silvery white dust. Antennae black; first and second joints short, third joint flattened, as long as the thorax, slowly tapering to the tip and covered with short and almost imperceptible pile; arista terminal, very short pubescent, its basal segment somewhat thickened. Front black, rather opaque. Postocular cilia abundant, snow white. Thorax and scutellum blackish metallic green, the latter with bluish reflections. Abdomen dark metallic cupreous green; edges of the segments black; basal segments bearing long pale hairs on their sides. Hypopygium shining black, with the protruding appendages; lamellae triangular, tapering, covered with erect hairs, black, each with a small white spot at its base; internal appendages club-shaped. Pleura thickly covered with gray dust, except above the base of the middle coxae where the metallic green ground-color is exposed. Coxae concolorous with the pleura, only their extreme tips yellow; anterior surfaces of fore coxae clothed with conspicuous silvery white hairs. Middle coxae each with a tuft of similar hairs and a couple of stout curved, black bristles. Legs plain, yellow, anterior tarsi from the tip of the first joint, the hind tibiae, which are somewhat incrassated, hind tarsi and the hind femora on their upper surfaces near the tip, black. Wings grayish hyaline, not narrowed towards their base; veins brown; third and fourth veins nearly parallel. Halteres and tegulae yellow, the latter with long white cilia.

Delaware County, Pennsylvania.

**Xiphandrium femoratum** new species (Text-figs. 1 and 4.)

♂: Length, 2.8 to 3 mm. Face narrow, of nearly parallel width, silvery white. Palpi black, their tips with white pollen like the face. Front violet. Antennae black; third joint fully as long as the height of the head, rather broad at base, gradully tapering; arista as long as the width of the front at vertex. Upper orbital cilia black, the white beard long and abundant.

Thorax and scutellum dark shining green with just the suggestion of a broad median vitta of blackish or violet; pleura with thin grayish white pollen.

Abdomen metallic green, more blue on the sides, sometimes almost wholly coppery, with conspicuous white hairs on the sides and venter. Hypopygium (fig. 1) black with stiff black hairs; the outer lamellae (fig. 4) lanceolate, black, more or less yellow at base, fringed with rather long pale hairs, some of which appear nearly black; inner appendages small, black, somewhat shovel-shaped, rather obliquely truncate at tip, with a pale stout bristle at the acute apical corner and a few stiff hairs back of this spine.

Fore coxae black with about apical half yellow, their anterior surface covered with long white hairs; middle and hind coxae black with narrow yellow tips, the former with two long black bristles on outer surface and with a few

long yellowish bristles at tip, which do not seem to form a spine as they usually do in this genus; hind coxae with one large black bristle and a few minute white hairs on outer surface. Fore femora black with extreme base and tip yellow; middle femora wholly yellow, with three preapical bristles, one in front and two on posterior side; hind femora yellow with apical half or two-fifths black, this black extends nearly to basal third on upper edge; they have one preapical bristle; all femora with short black hairs, no longer ones below. Fore and middle tibiae wholly yellow, each with several bristles above; hind tibiae wholly black. Fore and middle tarsi about as long as their tibiae, infuscated from the tip of the first joint, which is nearly as long as the remaining four taken together; hind tarsi scarcely as long as their tibiae, wholly black, slightly compressed, with the first and second joints of nearly equal length. Calypters and halteres pale yellow, the former with whitish cilia.

Wings grayish; third and fourth veins approaching each other a little and then parallel for a short distance at tip, the fourth ending in the apex of the wing; last section of fifth vein three times as long as the cross-vein and reaching the wing margin; sixth vein very close to the wing margin and nearly parallel with it, the wing being much narrowed at base.

♀: Face wide, green, thickly covered with gray pollen, divided near its middle by a suture, below which the ground color shows through a little; palpi large, black with gray pollen and black hairs; proboscis black; front violet edged with blue; antennae black, third joint elongate triangular, nearly twice as long as wide, arista thick, apical; a little longer than the antennae, its first joint short; the white beard very thin. Body color about as in the male; coxae, fore and middle femora, their tibiae and tarsi about as in the male, except that the fore coxae are mostly blackish and all coxae have shorter white hair. Hind femora yellow with apical fifth black; hind tibiae yellow with about apical third black; otherwise about as in the male.

Described from nine males and six females which I took at Wells, Nevada, June 6, 1915; several males and females taken by J. S. Hine, at Kodiak, Alaska, in June, 1917, and fifteen males and seven females taken by J. M. Aldrich, in Alaska in 1921; eight taken at Skagway, June 4; ten at Anchorage, June 10 to 13; three at Fairbanks, July 1, and one at Healy, June 21.

The *holotype* and *allotype* were taken at Wells, Nevada, and are in the author's collection.

**Xiphandrium femoratum** variety **pollex** new variety (Text-fig. 3.)

This form differs from the above described male in the inner appendages of the hypopygium having a thumb-like projection on their lower edge near the middle (figure 3); the fore coxae also seem to be less yellow at tip. The third antennal joint of what seems to be the female is slightly shorter than that of the females described above.

Described from two males and five females which I took at Wells, Nevada, June 6, 1915; one male taken by Mr. Cole at

Hood River, Oregon, June 21, 1917; several specimens taken by Prof. James S. Hine, at Kodiak, Alaska, in June, 1917, and one male taken by J. M. Aldrich, at Skagway, Alaska, June 4, 1921.

*Holotype* and *allotype* in the author's collection and taken at Wells, Nevada.

The male of *femoratum* differs that of *xipheres* Wheeler in having the inner appendages of the hypopygium more shovel-shaped, not at all club-shaped, and in having the hind femora much more blackened at tip. Wheeler's species is from the East, these forms from the West.

**Xiphandrium triangulatum** new species (Text-fig. 6.)

♂: Length, 2 mm. Face very narrow, in the type the eyes seem to touch in the middle of the face; below, it has silvery white pollen. Front blackish. Antennae black; third joint as long as the head-height, about as wide at base as the width of the front and tapering a little towards the top; arista thick, not much longer than the width of the third joint at base. Lateral and inferior orbital cilia white.

Thorax shining green; pleura dulled with white pollen.

Abdomen green with bronze reflections. Hypopygium black with rather long black hair; the outer lamellae (fig. 6) yellowish, with upper edge black and fringed with pale hairs; they are triangular with a stem at base; inner appendages very small.

Fore coxae pale yellow, a little blackened at base, their anterior surface covered with long white hair; I cannot see any black bristles or hairs at tip. Middle and hind coxae black, narrowly yellow at tip, the former with three black bristles near the tip on outer surface, the latter with one black bristle, middle pair with minute yellow hairs on the front surface and a yellow spine at tip. Femora yellow, the hind ones a very little blackened above at tip and with one preapical bristle. Middle femora with two preapical bristles, one on each side, and ciliate below with long yellow hairs on lower posterior edge, which are longer than femoral width. Fore and middle tibiae yellow, each with several bristles on upper surface; hind tibiae brownish yellow. Fore tarsi about as long as their tibiae, black from the tip of the first joint, which is not quite as long as the remaining four joints taken together. Middle tarsi a little longer than their tibiae, infuscated from the tip of the first joint, the base of the joints still paler, their tips blackish. Hind tarsi brown, their first joint a little shorter than the second. Calypters, their cilia and the halteres, yellow.

Wings grayish; beyond the cross-vein the third and fourth veins are a little arched so as to separate and then approach each other, still they are nearly parallel towards the tips, the fourth ending in the apex of the wing; last section of the fifth vein more than four times as long as the cross-vein; sixth vein nearly parallel with the margin of the wing, the wing being narrowed at base.

Described from one male taken at Oak Creek Canyon, Arizona, in August, at 6,000 ft. elevation, by F. H. Snow. *Type* in the author's collection.

**Xiphandrium flavicoxa** new species

♂: Length, 2 mm. Face very narrow below, wider above, silvery white. Front shining violet. Antennae black; third joint scarcely as long as the height of the head and not much wider at base than the width of the front; arista about as long as the width of the front. The orbital cilia seem to be wholly black (I can only see two or three of the lower ones).

Thorax greenish. Abdomen green with bronze reflections. Hypopygium black with four black hairs above, its lamellae small, triangular with a stem, yellowish at base, apical half black, fringed with minute pale hairs; I cannot see any inner appendages.

Coxae yellow; anterior and middle ones with yellow hairs on the front surface, the latter with a short yellow spine at tip and two or three black bristles on outer surface near the tip; hind coxae with one black bristle. Femora yellow, nearly bare below; middle ones with one small black bristle on each side near tip; hind pair with one preapical bristle; fore and middle tibiae yellow, the former with minute bristles and the latter with large ones. Hind tibiae brownish. Fore and middle tarsi a little longer than their tibiae, first joint as long as the following three joints taken together, yellow, becoming darker from the tip of the first joint. Hind tarsi black, with the second joint a little longer than the first. Calypters, their cilia and the halteres, yellow.

Wings tinged with yellowish brown; fourth vein nearly parallel with third from near the cross-vein, ending in the apex of the wing; last section of fifth vein about three times as long as the cross-vein; sixth vein short, parallel with the margin of the wing.

Described from one male taken at Lavender, Floyd County, Georgia, August, 1910, by J. C. Bradley. *Type* in the author's collection.

**Xiphandrium femineum** new species (Text-fig. 5.)

♂: Length, 2.5 mm. face wide, nearly as wide as usual in the female sex, a little narrowed below, silvery white. Palpi largely yellow. Front bright blue-green. Antennae black; third joint about as long as the height of the head, rather narrow and of about equal width to near its tip; arista about as long as the width of the face. Lateral and inferior orbital cilia and beard white.

Thorax greenish, dorsum dulled with brownish pollen; scutellum blue-green; posterior edge of the pleura yellow. Abdomen bronze green. Hypopygium (figure 5) black, with short black hairs and two spines at tip; outer lamellae somewhat triangular, small, apical half black, basal half yellowish; inner appendages rather large, black, pointed at tip with three stout yellow hairs.

Coxae wholly yellow; fore coxae with long white hairs; middle ones with a short yellow spine at tip and two small bristles on outer surface; posterior pair with one black bristle. Femora yellow, nearly bare below; posterior pair

considerably infuscated above at tip. Fore and middle tibiae yellow; hind tibiae wholly black, with three bristles above. Fore tarsi as long as their tibiae, black from the tip of the first joint, which is slightly widened at tip and as long as the remaining four joints taken together; middle tarsi as long as their tibiae, yellow, darker at tip; hind tarsi wholly black, with the first joint a little shorter and thicker than the second. Calypters their cilia and the halteres, yellow.

Wings dark grayish; third and fourth nearly parallel beyond the cross-vein, then slightly convergent and again nearly parallel at their tip, last section of fifth vein about two and one-half times as long as the cross-vein; wing narrowed at its base.

Described from one male, which I took at Rochester, New York, May 29, 1916. Type in the author's collection.

**Xiphandrium femineum** variety **dubium** new variety (Text-figs. 7 and 8.)

This form is like *femineum*, except that the outer lamellae are longer (figure 7) and apparently with longer stem; it is possible, but not probable, that they appear so on account of being more extended; the inner appendages (figure 8) are about the same in both forms. The first joint of the fore tarsus is a little shorter, being as long as the two following joints taken together, not as long as the following three joints, as is the case in *femineum*. The last section of fourth vein is very nearly straight in this form, being only slightly bent near its middle, while in *femineum* its bend is very distinct, although not great.

These are all structual characters and, although slight, would if constant give specific rank to this form, but until more material is secured I think it better to place it as a variety of *femineum*.

Described from one male, which I took at Gasport, New York, August 28, 1921. *Type* in the author's collection.

**Xiphandrium longicorne** new species (Text-fig. 2.)

♂ : Length, 3 mm. Head rather small. Face very narrow, silvery white, in the type the eyes touch in the middle of the face, probably because the head is shrunken. Palpi and proboscis black. Antennae black, its white pubescence conspicuous; third joint very long, nearly as long as the abdomen; in the type it is wavy, like a ribbon, of nearly equal width for nearly its entire length; arista short and thick, but as long as the width of the front. Front greenish, very short, not much more than a line and without bristles. Orbital cilia and beardwhite; I cannot see any black cilia above.

Dorsum of thorax and the scutellum shining green; pleura slightly dulled with whitish pollen. Abdomen green with coppery reflections, the lower portion of its sides with pale hairs. Hypopygium (fig. 2) black, without hair, but with scales of pollen; its lamellae developed into long ribbon-like black filaments, which are fringed with long bristly hairs; the inner appendages are also long filaments with long bristles at tip, enlarged a little at base.

Fore coxae wholly yellow; middle and hind ones black with yellow tips; fore and middle pairs with yellow hairs on their anterior surface, hind pair with yellow bristle on the outside; middle ones with a yellow spine at tip. Femora yellow, nearly bare below; posterior pair a little infuscate near the tip above. Tibiae yellow with only very small bristles; posterior tibiae slightly infuscated at tip. Fore and middle tarsi slightly longer than their tibiae, infuscated from the tip of the first joint; fore metatarsi as long as the following four joints taken together and with a row of minute bristles below. Hind tarsi scarcely as long as their tibiae, black from the tip of the first joint, which is dark yellowish and about as long as second joint. Calypters, their cilia and the halteres, yellow.

Wings grayish; last section of fourth vein bent near its middle, where it is quite widely separated from third vein, the third vein running rather close to second as far as this point, from this point the third and fourth veins approach each other a little, then run nearly parallel to their tips, the fourth ending in the apex of the wing; last section of fifth vein about two and one-half times as long as the cross-vein; sixth vein quite widely separated from the wing margin, the anal angle of the wing being somewhat prominent.

Described from one male, taken by L. O. Jackson, at Geneva Park, Grant County, Colorado, July 23, 1910, at an elevation of about 9,000 feet. *Type* in the author's collection.

Perhaps a new genus should be formed to receive this species, based on the small front and its lack of bristles, but as it is possible that the bristles may have been broken off in the single specimen we have, it seems best to wait until more material is found. Otherwise it fits well in this genus.

**Xiphandrium aldrichi** new species (Text-figs. 9 and 10.)

♂: Length, 2.75 to 3 mm. Face white, not very narrow. Front green, dull. Palpi blackish or yellowish brown, small. Antennae black, nearly twice as long as the height of the head; third joint of about equal width, ribbon-like, somewhat folded up, pubescent; arista very short, scarcely as long as the width of the third joint. Lateral and inferior orbital cilia white.

Thorax green, dulled with gray pollen. Abdomen green with black hair, those on the lower edge of the sides yellow. Hypopygium and its appendages black; there are two pair of lamellae-like appendages (figs. 10 and 9), these do not seem to be united at base, but I do not see that either can be called an outer or inner appendage as in other species; one is long and furnished with long pale hairs, the other pair have an oval tip tapering into a slender stem, these also have long pale hairs.

Fore coxae yellow, slightly darker on outer side at base; middle and hind coxae black on basal, yellow on apical half; the hairs and bristles of all coxae yellow. Femora and tibiae yellow, only the tips of posterior tibiae brown, their bristles very small. All tarsi blackened from the tip of the first joint; fore tarsi about as long as their tibiae, the first joint but little longer than the

second: middle pair one and one-fourth times as long as their tibiae, hind tarsi slightly thickened, about equal to their tibiae in length, first and second joints of about equal length. Calypters, their cilia and the halteres, yellow.

Wings gray; third and fourth veins approaching each other from about the middle of the last section of the fourth vein, but nearly parallel at tips, fourth ending in the apex of the wing; last section of fifth vein fully twice as long as the cross-vein; anal angle rounded, the wing being rather abruptly narrowed at its root.

♀: Color, venation and form of the tarsi about as in the male. Face wide, whitish; palpi black, large; antennae with the third joint somewhat triangular, but little longer than wide; arista about as long as the height of the head, slender.

Described from two males and one female, taken at Healy, Alaska, June 24, 1921, by J. M. Aldrich, for whom I am naming this interesting species. *Holotype* and *allotype* in the United States National Museum.

Fig. D.

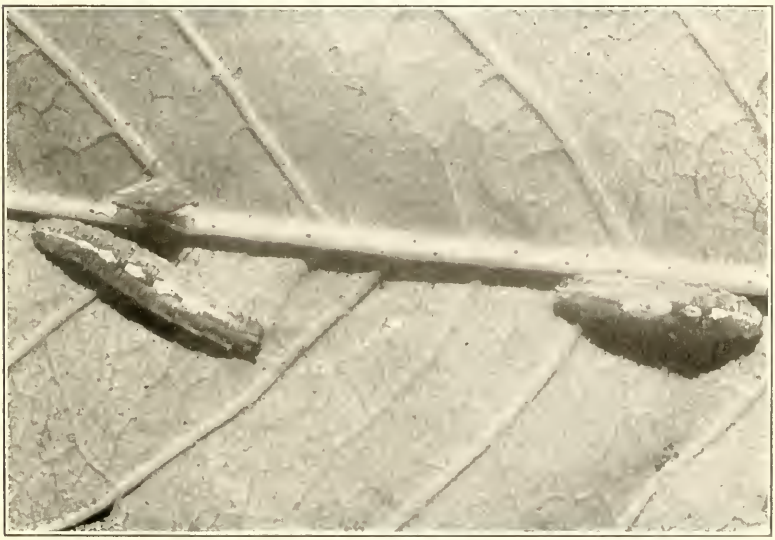
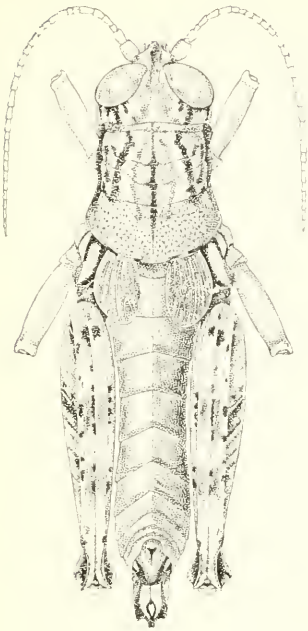


Fig. E.

DAVIDSON—NOTES ON MELANOSTOMA



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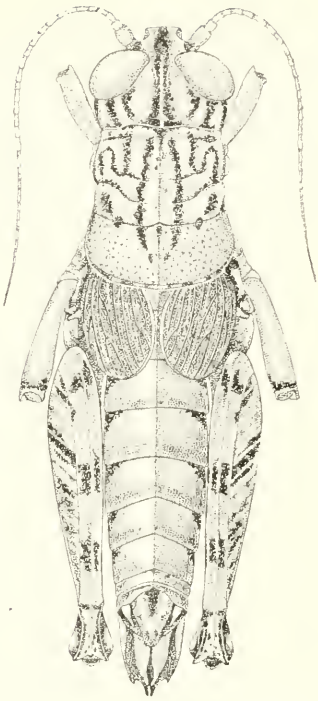

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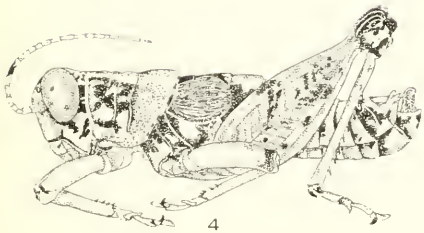

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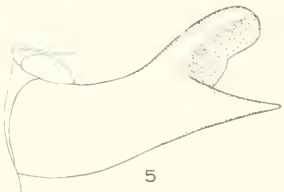

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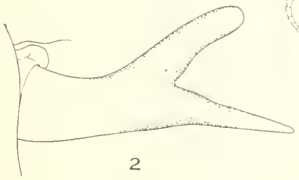

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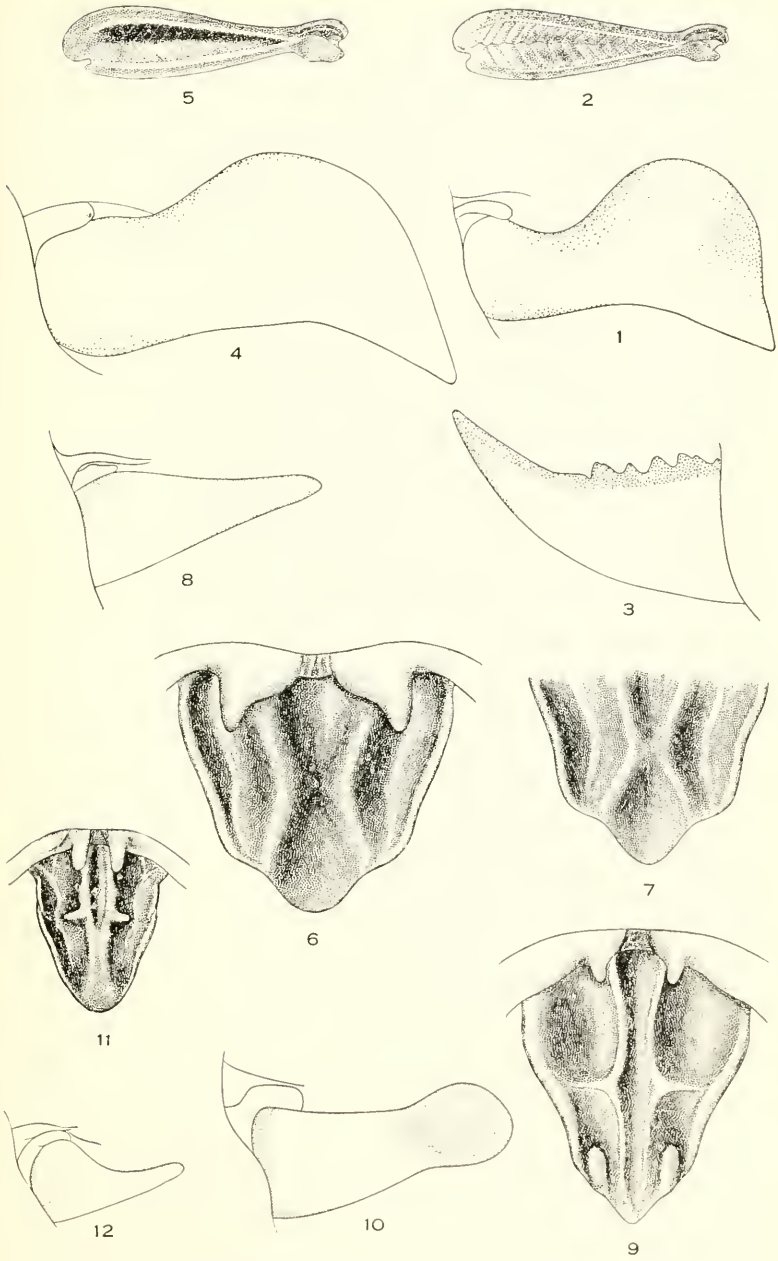
HEBARD—NEW NORTH AMERICAN MELANOPLI




HEBARD—NEW NORTH AMERICAN MELANOPLI

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# NORTH AMERICAN ACRIDIDAE (ORTHOPTERA)

## PAPERS 1 AND 2

BY MORGAN HEBARD

## PAPER ONE

### A Study of the Group Achuri, as Found in the United States

The Achuri, here separated for the first time, come first among the North American groups in the Subfamily Acridinae (= Truxalinae of authors). As our field work has resulted in the assembling of material of all the forms found in the United States, we have decided to present the results of the study of the series now available.

No affinity with the Group Hyalopteryges exists, the nearest relationship apparently being with the Old World Group Odontomeli. In the linear arrangement of the North American Acridinae, *Achurum* and *Radinotatum* come first, then *Pseudopomala* and *Mermiria* of the Group Mermiriae, followed by *Truxalis*, a true Hyalopterygine genus.

Comparison has been made with material of the other Hyalopterygine genera *Hyalopteryx*, *Eutryxalis* and *Paratruxalis*, as well as several genera of the Group Odontomeli in the Philadelphia Collections.

The Achuri are distinguished by the very slender, elongate form; the produced, horizontal head, with vertex laterally and medio-longitudinally carinate; the weakly defined lateral or ventro-lateral foveolae; the ensiform antennae; the long pronotum with disk flattened, lateral and medio-longitudinal carinae parallel and straight and the very shallow lateral lobes; the slender, acuminate tegmina and wings (when fully developed), the latter with no fenestrate area in either sex; the prosternum with cephalic portion slightly convex; the very slender caudal femora with dorsal and ventral genicular angles produced, and the conical (strongly to greatly) produced male subgenital plate.

Two genera, three species and one geographic race are included, all occurring in the territory under consideration, though two of the species find their northernmost limit of distribution just over the Mexican line in the United States.

In the present study nine hundred and nine specimens have been examined, four hundred and fifty of these having been previously reported by Rehn and Hebard, individually or jointly. We feel that the limits of distribution of each form are now roughly definable for the regions being studied. Unless otherwise stated the material collected by Rehn and Hebard, individually or jointly, is in the collection of the author or that of the Academy of Natural Sciences of Philadelphia.

The following key includes the features by which the forms here discussed may be readily distinguished.

(Form very slender, linear. Antennae ensiform. Head horizontal, dorsal length greater than that of pronotum. Pronotum with metazona one-half as long as prozona or shorter; disk deplanate, with lateral and medio-longitudinal carinae distinct and parallel. Tegmina and wings vestigial or fully developed; the former, when fully developed, with apices sharply rounded, nearly acute and without a fenestrate area in either sex. Caudal femora with dorsal and ventral genicular angles well produced.)

A. Head with lateral carinae of vertex overhanging the very weak lateral foveolae; the latter with ventral delimiting carina very weak, but best indicated mesad. (Pronotum with caudal margin convex, showing weak obtuse-angulation.) Tegmina and wings fully developed. Male subgenital plate with length nearly equal to length of preceding sternite. Dorso-external genicular angles of caudal femora slightly the longer. Mountains of extreme southern Arizona, southward. **Achurum** Saussure

*Genotype.*—**sumichrasti** Saussure

AA. Head with lateral carinae of vertex not overhanging the very weak lateral foveolae; the latter with ventral delimiting carina very weak, but best indicated distad. Tegmina and wings greatly reduced or vestigial. Male subgenital plate with ventral length decidedly greater than that of preceding sternite. Dorso-internal genicular angles of caudal femora the longer.

B. Pronotum with caudal margin broadly convex. Tegmina and wings greatly reduced, overlapping; the former with apices well rounded in males, sharply rounded to different degrees in females. (Male subgenital plate with length nearly twice that of preceding sternite.) Dorsal genicular angles of caudal femora distinctly more produced than ventral. Brownsville region of Texas, southward into eastern Mexico.

**Radinotatum minimipenne** (Caudell)

BB. Pronotum with caudal margin weakly concave. Tegmina and wings vestigial, linear, lateral; the former with apices sharply rounded, nearly acute. Dorsal genicular angles of caudal femora much more strongly produced than the ventral.

C. Head shorter, vertex less produced and face less concave. Antennae shorter. Pronotum with lateral lobes deeper. Male subgenital plate shorter and heavier. Caudal femora shorter and heavier. Southeastern states, in Florida south to central peninsular portion.

**Radinotatum brevipenne brevipenne** (Thomas)

*Genotype* of **Radinotatum**

CC. Head longer, with vertex much more produced and face more concave. Antennae longer. Pronotum with lateral lobes shallower. Male subgenital plate longer and more slender. Caudal femora longer and more slender. Southern peninsular Florida.

**Radinotatum brevipenne peninsulare** R. & H.

Tuberculation of the prosternum and number of caudal tibial spines are of hardly any value as generic criteria in this group. The prosternum does not bear a small tubercle, as has been stated in past literature. The number of spines on the dorsoexternal margin of the caudal tibiae is individually variable and unsafe as a generic character. The extremes and average for the species before us show the difference between *Achurum* and *Radinotatum* to be much less in this respect than has been supposed.

**Achurum sumichrasti** (Saussure) (Plate IV, figures 1, 2, 3 and 4.)

1861. *Tr[uxalis (Achurum)] sumichrasti* Saussure, Rev. et Mag. de Zool., XIII, p. 313. [♀, Temperate Mexico.]

1873. *T[ruxalis] acridodes* Stål, Ofv. K. Vetensk.-Akad. Förh., 1873, no. 4, p. 52. [♂, Mexico.]

1897. *Achurum sumichrasti* McNeill, Proc. Davenport Acad. Nat. Sci., VI, p. 202, pl. I, figs. 2, 2a, 2b, 2c. [Fort Grant, Arizona.[1]]

1904. *Rhadinotatum brevipenne* Bruner (not *Tryxalis brevipenne* Thomas, 1873), Biol. Cent.-Amer., Orth., II, p. 34. ["♂", juv.; Orizaba, [Vera Cruz], Mexico.[2]]

[1] This is the first record of the species from the United States. Scudder (Index, N. A. Orth., p. 5, (1901)) is in error in crediting to Thomas a record of *A. acridodes* from the western United States. Thomas stated, "The following new species is described from Mexico by Stål," after having remarked on page 851 that no adult Truxalids were in the collection there reported. (Rept. Geol. Geogr. Expl. Surv. West of 100th Merid., Wheeler, V, p. 865, (1875).)

[2] The specimens upon which this record, from memory, was based are in the Hebard Collection ex Bruner. The reason that author was unable to find them when preparing the manuscript for the Biologia appears to be that, in the interim, he had recognized them as immature examples of *Achurum sumichrasti* and had so labelled them, afterwards forgetting that assignment.

1907. *Achurum acridodes* Rehn, Proc. Acad. Nat. Sci. Phila., 1907, pp. 31 and 69. [♂, ♀; Carr Canyon, Huachuca Mountains; Palmerlee, and Baboquivari Mountains, Arizona.]

1907. *Achurum acridodes* Snow, Trans. Kansas Acad. Sci., xx, part ii, p. 36. [Baboquivari Mountains, Arizona.]

The type of this species is probably in the Geneva Museum.

The sides of the vertex normally show weak convergence. In rare examples, however, they are parallel to the rounded apex, as is normal in *Radinotatum*. The disk of the pronotum toward the cephalic margin and the entire metazonal portion is minutely impresso-punctate, individually varying through all stages to minutely and longitudinally rugulose. This variation and the sexual difference (the male being smaller and distinctly more slender) led Stål to describe, as *acridodes*, a male showing the impresso-punctulate type. The validity of that name has constantly been questioned and the material now before us satisfactorily proves the synonymy indicated above.[3] Those individuals having the pronotal disk brown appear to be more liable to have it more generally roughened with rugae more decided. The genicular lobes of the caudal femora vary slightly in length and slenderness, but this does not appear to be sufficiently decided or stable to warrant racial or other nominal recognition. The number of dorso-external spines of the caudal tibiae varies from thirteen to seventeen, the average being fifteen.

In the half-grown and larger immatures of this species the supra-anal plate is short and truncate, but beyond it projects, as a slenderly conical process, an elongate terminal segment (plate IV, figure 4). This process is similar in the series, longer than the pronotum, straight, with dorsal surface concave between

[3] The following Mexican material is before us.

Guadalajara, Jalisco, (D. L. Crawford), 6 ♂, 7 ♀; VIII, 20 and IX, 18, 1903, (J. F. McClendon), 2 ♀, [all A. N. S. P.].

Vera Cruz, (A. Sallé), 1 ♂, [Hebard Cln.].

Orizaba, Vera Cruz, I, 1892, (L. Bruner), 2 juv. ♂, 1 juv. ♀, [Hebard Cln.].

Cuernavaca, Morelos, (D. L. Crawford), 1 ♂, 1 ♀; I, 4, 1899, (L. Bruner), 1 juv. ♂, [all Hebard Cln.].

Chilpancingo, Guerrero, 4600 feet, VI and VIII, (H. H. Smith), 1 ♂, 1 ♀, [Hebard Cln.]

Tonala, Chiapas, VIII, 7, 1909, (A. Petrunkevitch; hill about 1000 feet high), 1 ♀, [A. M. N. H.].

lateral carinae, its surface convex elsewhere, with a strong mediolongitudinal ventral carina. This entire segment disappears in the adult, the supra-anal plate in both sexes being small, trigonoshield-shaped, with apex bluntly rounded. It was the purely superficial, but quite apparent, resemblance of this appendage to the subgenital plate of males of *Radinotatum brevipenne* (Thomas) which misled Bruner into recording immatures of the present insect as that species.

*Measurements (in millimeters)*

| | Length of body | Length of pronotum | Caudal width of pronotal disk | Length of tegmen | Length of caudal femur |
|---|---|---|---|---|---|
| ♂ | | | | | |
| Carr Canyon, Huachuca Mts., Arizona | 26.8 | 4.1 | 1.7 | 23.8 | 12 |
| Fort Grant, Arizona | 28.2 | ... | ... | 24.8 | 12.6 |
| Fort Grant, Arizona | 29.8 | 4.5 | 1.9 | 24.2 | 12.1 |
| Black Dike Prospect, Arizona | 28.8 | 4.3 | 1.8 | 24.3 | 12 |
| Baboquivari Mountains, Arizona | 29 | 4.5 | 1.9 | 25.3 | 12.8 |
| ♀ | | | | | |
| Fort Grant, Arizona | 36.2 | 5.5 | 2.1 | 30 | 14.8 |
| Fort Grant, Arizona | 38.5 | 5.3 | 2.1 | 30.8 | 14.8 |

The largest female before us, from Tonala, Chiapas, Mexico, measures: length of body, 37 (shrivelled); length of pronotum, 5.9; caudal width of pronotal disk, 2.2; length of tegmen, 34; length of caudal femur, 16.8 mm.

The color phases are as follows. A. All brown. B. Brown, with dorsal surface of head, pronotum and tegmina green. C. All green, with a post-ocular band of brown, continued along the dorsal margin of the pronotal lateral lobes and expanding to different degrees on the lateral surfaces of the tegmina. Variation from brown to yellowish-brown is also shown.

The habits of this species have never been discussed. Rehn secured a single specimen in the Sierritas above Black Dike Prospect, Arizona, while beating "bear grass" (*Nolina* sp.). No further specimens were found during three hours' work.

In addition to twenty-five Mexican individuals, seven from the United States are before us, all of the latter having been recorded previously and belonging to the Philadelphia Collections, except the following male.

Seven miles above Black Dike Prospect, Sierritas Mountains, Pima County, Arizona, 4700 to 4825 feet, VII, 28, 1916, (J. A. G. Rehn), 1 ♂, [A. M. N. H.].

**Radinotatum minimipenne** (Caudell) (Plate IV, figures 5, 6 and 7.)
1904. *Achurum minimipenne* Caudell, Sci. Bull., Mus. Brooklyn Inst. Arts and Sci., I, p. 110, pl. VI, figs. 3 and 4. [♀, Brownsville, Texas.[4]]

The type is in the collection of the Museum of the Brooklyn Institute of Arts and Sciences.

As Caudell has stated, "this species seems to form a connecting link between *Achurum* and *Radinotatum*." Nearer affinity is, however, with the latter and, from study of the material before us, we feel fully justified in transferring *minimipenne* to that genus.

The vertex is much like that of *R. brevipenne* (Thomas), the lateral margins not overhanging and less convergent than is normal in *Achurum*. The lateral foveolae are subobsolete, agreeing with *brevipenne* in facing laterad, with delimiting ventral carina indicated only distad; in *Achurum* the lateral foveolae face ventro-laterad, with delimiting ventral carina indicated only mesad. The caudal margin of the pronotum is not concave as in *brevipenne*, nor is it nearly as strongly angulate-produced as in *Achurum*. It is very possible that the differences shown in this feature in these species, is wholly attributable to modification resulting from degree of reduction of the organs of flight. Such difference should, in consequence, be given little generic value. In the genicular lobes of the caudal femora we find much closer agreement with *brevipenne*, the dorsal pairs being decidedly the more produced, the dorso-internal the longer. In *brevipenne* the only difference is that the production of the dorsal lobes is much greater. Similar closer affinity is found in the form of the male subgenital plate. The dorso-external spines of the caudal tibiae vary individually in number from fourteen to seventeen in the material here recorded, the average being sixteen.[5] When we consider that *brevipenne* has from sixteen to twenty-three such spines, and *Achurum* thirteen to seventeen, we see that this feature is of little value from a generic point of view.

The genera *Achurum* and *Radinotatum* are close, but the former, as here limited, may be quickly separated by the structure of the fastigium of the vertex, of its lateral foveolae and the proportions of the genicular lobes of the caudal femora.

[4] Both sexes were at the same time recorded from Esperanza Ranch, near Brownsville, Texas.

[5] In one specimen from Tampico, Tamaulipas, Mexico, one of the caudal tibiae has nineteen such spines.

*Measurements (in millimeters) of extremes*

| ♂ | Length of body | Length of pronotum | Caudal width of pronotal disk | Length of tegmen | Length of caudal femur |
|---|---|---|---|---|---|
| Brownsville, Texas (8) | 24.8–26 | 3.7–3.9 | 1.1–1.2 | 6.7–7.5 | 12.9–13.8 |
| Piper Plantation, Texas (23) | 24.1–26.5 | 3.5–4 | 1.1–1.2 | 6.8–7.3 | 12.7–14.8 |
| Lyford, Texas (2) | 26–26.1 | 3.7–3.8 | 1.2–1.2 | 7.2–7.3 | 12.8–13.8 |
| Tampico, Mexico | 25 | 3.8 | 1.3 | 7 | 14.2 |
| Pueblo Viejo, Mexico | 21.4–25.3 | 3.3–4 | 1.2–1.4 | 6.7–7.7 | 11.8–13.2 |
| ♀ | | | | | |
| Lyford, Texas | 33.8 | 5.3 | 2 | 7.8 | 16.7 |
| Piper Plantation, Texas (17) | 30.8–34.2 | 4.8–5.1 | 1.8–2 | 6.2–7.8 | 15.5–17 |
| Tampico, Mexico (2) | 32.1–31.5 | 5.1–5.1 | 2–2 | 6.7–7.5 | 15.2–16 |
| Pueblo Viejo, Mexico | 30 | 5 | 1.9 | 6.8 | 14.8 |

In addition to a light brown color phase, the following are noted. Male: dorsal surface of head and pronotum, all of tegmina and caudal femora to distal portions light green, other portions light brown. Female: face and genae, lateral lobes of pronotum, lateral portions of tegmina and caudal femora to distal portions light green, other portions light brown, the dorsal surfaces of the head, pronotum and tegmina palest. In one brown female from Tampico, Mexico, the tegmina alone are greenish.

Near Brownsville, Texas, the species was found locally quite numerous in the low, coarse grass growing in openings of the thorny tangle, choking the low-lands near the Rio Grande. The species is not very active and, once found, a series was easily secured.

This insect was previously known only from the material originally reported by Caudell. Its distribution is now found to extend from Mercedes and Lyford, in the Brownsville region of Texas, south to Pueblo Viejo, at the extreme northern extremity of Vera Cruz, on the Gulf of Mexico.

*Specimens Examined*, in addition to a pair previously recorded: 68; 37 males, 21 females and 10 immature individuals.

TEXAS: Lyford, Cameron County, VIII, 6 and 7, 1912, (R. and H.), 2 ♂, 1 ♀. Mercedes, Cameron County, II, 1909, (T. D. Urbahns), 1 juv. ♀, [U. S. N. M.]. Brownsville, VII, 31 to VIII, 5, 1912, (Hebard), 8 ♂, 1 juv.

♂, 2 juv. ♀. Piper Plantation, near Brownsville, VIII, 3, 1912, (R. and H.), 23 ♂, 17 ♀, 3 juv. ♂.

Mexico: Tampico, Tamaulipas, XII, 1906, (C. A. Hart), 1 ♂, 2 ♀, [Hebard Cln.]. Pueblo Viejo, Vera Cruz, XII, 8, 1909, (F. C. Bishopp), 3 ♂, 1 ♀, [U. S. N. M.].

**Radinotatum brevipenne brevipenne** (Thomas) (Plate IV, figure 8.)

1873. *Tr[yxalis] brevipenne* Thomas, Rept. U. S. Geol. Surv. Terr., v, pl. Synopsis Acrid., fig. 12. [♀; Palatka, Florida.]

1897. *Radinotatum brevipenne* McNeill, Proc. Davenport Acad. Nat. Sci., VI, p. 200, pl. I, figs. 1, 1a and 1b. [♂, ♀; Orange, Florida.]

1902. *Rhadinotatum brevipenne* Blatchley, A Nature Wooing, p. 219. [Ormond, Florida.]

1904. *Rhadinotatum brevipenne* Morse, Carnegie Inst. Washington, Publ. no. 18, p. 28. [Juv.: Savannah and Waycross, Georgia; De Funiak Springs, Live Oak and Tallahassee, Florida; Greenville, Alabama.]

1905. *Radinotatum brevipenne* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1904, p. 783. [♂, ♀, juv.: Thomasville, Georgia; Leon County, Florida.]

1907. *Radinotatum brevipenne* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1907, p. 285. [♂, ♀, juv.; Pablo Beach and Gainesville, Florida.]

1912. *R[adinotatum] brevipenne* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1912, p. 247, figs. 2, 4, 6, 8 and 10. (Comparison with *Radinotatum brevipenne peninsulare* R. and H.)

1914. *Radinotatum brevipenne* Davis, (in part), Jour. N. Y. Ent. Soc., XXII, p. 194. [♂, ♀; La Grange, Florida.[6]]

1916. *Radinotatum brevipenne brevipenne* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1916, p. 153. [♂, ♀, juv.: Yemassee, South Carolina; Augusta, Warm Springs, Macon, Isle of Hope, Sandfly, Jesup, Brunswick, Homerville, Hebardville, Suwannee Creek, Billy's Island, Honey Island, Albany and Spring Creek, Georgia; Jacksonville, Atlantic Beach, Pablo Beach, Live Oak and Cedar Keys, Florida.]

1920. *Rhadinotatum brevipenne* Blatchley, (in part), Orth. N. E. Amer., p. 195, figs. 72 and 73. [Dunedin, Florida;[7] Agricultural College, Mississippi.]

Typical *brevipenne* and the south Floridian race *b. peninsulare* were thoroughly compared by Rehn and Hebard in 1912. Blatchley, in the last paper referred to above, refuses to recognize the southern race of this species. He quotes our statement that "Lakeland individuals are absolutely intermediate," and that "In central Florida the species (i. e., by inference the typical race) intergrades with its geographic race *R. brevipenne peninsulare*" as proof of our error. Apparently he does not realize that an area of intergradation lies between the geographic races of a species, unless the latter be insular or has in some other manner been completely separated from the parent stock. We reiterate that Lakeland material is intermediate; that

[6] The Miami female should have been referred to *R. b. peninsulare*.

[7] Probably intermediate between *b. brevipenne* and *b. peninsulare*.

locality in central Florida being in the area of intergradation between the races of *brevipenne*. Blatchley's experience with the present species has been almost wholly with material from Dunedin, another locality in the area of intergradation, where strong individual variation is often found. His statement that "All distinctions as given are comparative only and may be found in any large series of specimens taken almost anywhere in Florida" is correct in the first part, but erroneous in the second. Both races are individually variable, but any series from southern Florida may be easily separated from any series from the northern portions of the species' range.

The dorso-external spines of the caudal tibiae vary in number from sixteen to twenty in the material before us, the average being eighteen.

The following measurements are given to show the differences in proportions found in *brevipenne brevipenne*, atypical *brevipenne* and *brevipenne peninsulare*.

| | Length of body | Length of vertex[8] | Length of pronotum | Length of tegmen | Ventral length of subgenital plate | Length of caudal femur |
|---|---|---|---|---|---|---|
| ♂ | | | | | | |
| *Brevipenne brevipenne* | | | | | | |
| Macon, Georgia... | 26.8 | 1.65 | 3.8 | 4.8 | 3 | 15 |
| Thomasville, Georgia (5).... | 30–28.4 | 1.65–1.75 | 4–3.9 | 5.8–6 | 3.6–3 6 | 14.3–13.8 |
| Hebardville, Georgia (7).... | 28–29.8 | 1.54–1.75 | 3.8–4 | 5.3–5.2 | 3 4–4 | 14.2–14.9 |
| Ocala, Florida (9) | 29–30.3 | 1.7–1.84 | 4–4.1 | 4–4.8 | 3.1–3.8 | 13.2–14.1 |
| Atypical *brevipenne* | | | | | | |
| Kissimmee, Florida (28)... | 27.8–33 | 1.84–2.02 | 3.7–4.3 | 3.8–5 | 2.8–4.3 | 12.9–15.8 |
| Lakeland, Florida (10)... | 26.8–29 | 1.7–1.86 | 3.2–3.6 | 3.8–4.3 | 3–4 | 12.5–13.7 |
| Arcadia, Fla. (12) | 29.5–34.7 | 1.84–2.15 | 3.8–4 | 3.9–4.7 | 3.3–4.9 | 13.8–15.2 |
| *Brevipenne peninsulare* | | | | | | |
| Fort Myers, Florida (35)... | 32.3–35.5 | 2.04–2.16 | 3.8–4.1 | 3.6–4.1 | 4.2–5 | 13.7–15.1 |
| Fort Reed, Florida (2).... | 33.6–34.7 | 1.95–2.18 | 4–4.1 | 4–5.2 | 4.4–4.8 | ... –15.4 |
| Miami Beach, Florida (4).... | 33–35.6 | 2.02–2.31 | 3.9–4 | 4.3–4.1 | 4.1–5 | 15–15.4 |
| Homestead, Florida (85).... | 34.2–35 | 2.06–2.18 | 4.1–4 | 4.7–4.8 | 4.3–4.7 | 15–16.3 |
| Big Pine Key, Florida[9] (30)... | 28.8–31 | 1.72–1.91 | 3.3–3.7 | 3.1–3.8 | 3.3–4.1 | 12.7–14.2 |

[8] These measurements and the proportions given below the tables were taken by micrometer.

[9] This series is decidedly depauperate, the proportions, however, being typical of *b. peninsulare*.

| ♀ | Length of body | Length of vertex[8] | Length of pronotum | Length of tegmen | Length of caudal femur |
|---|---|---|---|---|---|
| *Brevipenne brevipenne* | | | | | |
| Thomasville, Georgia (2)..... | 37–38.8 | 2.15–2.31 | 5.8–5.8 | 7–7.1 | 17.8—... |
| Hebardville, Georgia (5)..... | 35.8–39.6 | 2.08–2.38 | 5–5.9 | 6.8–6.2 | 15.9–18.6 |
| Jacksonville, Fla... | 40 | 2.36 | 5.9 | 6.4 | 17.8 |
| Ocala, Florida (4).. | 36.4–39.8 | 2.1–2.16 | 5–5.7 | 5.4–5 | 15.8–17.4 |
| Atypical *brevipenne* | | | | | |
| Kissimmee, Florida (19).... | 39.8–45.8 | 2.31–2.79 | 5.3–6 | 5.7–6.4 | 16.8–18.8 |
| Lakeland, Fla. (7). | 37–39 | 2.15–2.18 | 5–6 | 4.7–5.3 | 15.7–16.8 |
| Arcadia, Fla. (5).. | 38–43.5 | 2.18–2.58 | 5.1–5.8 | 5.2–5.9 | 16.5–18.3 |
| *Brevipenne peninsulare* | | | | | |
| Fort Myers, Florida (6)..... | 40–42 | 2.38–2.69 | 5.3–5.8 | 5.1–4.8 | 17–16.5 |
| Chokoloskee, Fla.. | 49 | 3.1 | 6.6 | 6.8 | 21.5 |
| Homestead, Florida (41).... | 42–47 | 2.65–2.7 | 5.2–5.8 | 5.8–5.9 | 17.8–19 |
| Big Pine Key, Florida[9] (6)..... | 37–39.5 | 2.16–2.31 | 5–4.9 | 4.6–4.8 | 16.4–17.2 |

The extremes of the series show the width of the vertex contained the following number of times in its length:

Males. *Brevipenne brevipenne.* Macon, 1.29; Thomasville, 1.23 to 1.24; Hebardville, 1.18 to 1.44; Billy's Island, 1.34; Ocala, 1.35 to 1.37. Atypical *brevipenne.* De Leon Springs, 1.53; Kissimmee, 1.5 to 1.74; Lakeland, 1.47 to 1.84; Tampa, 1.5 and 1.5; Arcadia, 1.46 to 1.77. *Brevipenne peninsulare.* Fort Myers, 1.7 to 1.84; Fort Reed, 1.56 to 1.63; Miami Beach, 1.71 to 2.04; Homestead, 1.6 to 1.83; Big Pine Key, 1.51 to 1.79.

Females. *Brevipenne brevipenne.* Thomasville, 1.21 to 1.22; Hebardville, 1.17 to 1.23; Jacksonville, 1.23; Ocala, 1.25 to 1.27. Atypical *brevipenne.* Kissimmee, 1.36 to 1.54; Lakeland, 1.25 to 1.39; Arcadia, 1.31 to 1.41. *Brevipenne peninsulare.* Fort Myers, 1.45 to 1.52; Fort Reed, 1.31 to 1.37; Homestead, 1.43 to 1.59; Big Pine Key, 1.45 to 1.49.

These proportions for *brevipenne brevipenne* are seen to be: ♂, 1.18 to 1.44, a mean of 1.31; ♀, 1.17 to 1.27, a mean of 1.22. For *brevipenne peninsulare* they are: ♂, 1.51 to 2.04, a mean of 1.77; ♀, 1.31 to 1.59, a mean of 1.45.

The measurements serve better to separate the races of this species than any diagnosis we could give. Though in general appearance very different, careful comparisons of series show both *b. brevipenne* and *b. peninsulare* to be subject to considerable individual variability. Only in the area of intergradation, however, are individuals encountered in the same series referable to both types. It is of interest to note that this area of intergradation lies much more to the north on the East than on the West Coast of Florida, apparently forming a broad oblique

band across the state. It includes the following localities as indicated by material before us: De Leon Springs to Trilby on the north, Fort Reed,[10] Kissimmee and Arcadia on the south.

The following color phases are developed in this species. A. Both sexes often with general coloration light yellowish brown to dark brown, sometimes speckled with darker brown, rarely with lateral carinae of pronotum very narrowly buffy. Rarely the dorsal surface of head, pronotum and abdomen is blackish brown in this and the laterally green phase. B. Frequent males are brown with dorsal surface of head, pronotum, proximal portion of abdomen and tegmina green. C. Frequent females, very rarely males, are green, with dorsal surface of head, pronotum and all of abdomen brown, the caudal femora sometimes suffused distad with brown.

Map 1. Showing distribution of *Radinotatum brevipenne brevipenne* by dots, of *Radinotatum brevipenne peninsulare* by squares, and of material intermediate between these races by circles.

This insect is everywhere met with in the pine-needles and slender grasses of the pine forests which extend over the greater portion of its distribution, where its remarkably slender form

[10] The series recorded from this locality by Scudder is before us.

and coloration are unusually protective in character. As is usual with such forms of insect life, it is not particularly active. The species is also found, however, among grasses in open areas, along the borders of forests and in damp situations.

Over the greater portion of its distribution *brevipenne brevipenne* is a spring form, frequent immatures, but adults almost never, being met with after midsummer. In the southern portion of its distribution, however, like its more southern race, it is to be found adult both in Spring and Fall, and is probably present in that stage throughout most of the year.

The northern limit of distribution of typical *brevipenne*, as now known, runs through Yemassee, South Carolina; Augusta, Macon and Warm Springs, Georgia; Montgomery and Selma, Alabama; Agricultural College and Jackson, Mississippi. It is probably limited in western distribution by the eastern escarpment and delta country of the Mississippi River. In peninsular Florida it is found typical as far south as Palatka, Ocala and Dunellon.

*Specimens Examined*, in addition to 123 previously recorded: 218; 26 males, 15 females, 177 immature individuals.

Georgia: Groveland, IX, 21, 1917, (R. and H.; juv., few in forest undergrowth), 3 juv. ♂, 4 juv. ♀. Billy's Island, Okeefenokee Swamp, VII, 16 to 19, 1917, (Hebard; undergrowth in long-leaf pine forest), 1 ♀. Bainbridge, IX, 5, 1915, (R. and H.; juv. occasional in pine and oak woods undergrowth), 4 juv. ♂, 5 juv. ♀.

Alabama: Dothan, IX, 6, 1915, (R. and H.; juv. occasional in drier spots of low long-leaf pine woods), 3 juv. ♂, 4 juv. ♀. Montgomery, IX, 8, 1915, (R. and H.; juv. occasional in grasses of short-leaf pine woods), 1 juv. ♂, 3 juv. ♀. Greenville, VIII, 3, 1915, (Hebard; juv. in grasses on edge of forest), 1 juv. ♀. Flomaton, VIII, 27, 1915, (R. and H.; few juv. in undergrowth of pine woods), 2 juv. ♀. Selma, IX, 9, 1915, (R. and H.; few juv. in grasses on edge of lowland woods), 1 juv. ♂, 4 juv. ♀. Mobile, VIII, 26, 1915, (R. and H.; juv. occasional in undergrowth of long-leaf pine flat-woods), 3 juv. ♂, 2 juv. ♀. Springhill, Mobile County, VIII, 25, 1915, (R. and H.), 3 juv. ♂, 2 juv. ♀. Irvington, VIII, 26, 1915, (R. and H.; juv. occasional on damp ground among bog plants and grasses), 2 juv. ♂, 5 juv. ♀. St. Elmo, VIII, 26, 1915, (R. and H.; juv. occasional in undergrowth of long-leaf pine flatwoods), 2 juv. ♂, 5 juv. ♀.

Mississippi: Meridian, IX, 10, 1915, (R. and H.; juv. scarce about small areas of coarse grass in mixed forest), 3 juv. ♂, 3 juv. ♀. Hattiesburg, IX, 11, 1915, (R. and H.; juv. moderate numbers in undergrowth of long-leaf pine forest), 3 juv. ♂, 8 juv. ♀. Jackson, IX, 12, 1915, (R. and H.; juv. moderate numbers in grasses of mixed forest on hills), 6 juv. ♀. Brookhaven, IX, 15, 1915, (Rehn; juv. in mixed forest), 12 juv. ♂, 13 juv. ♀.

Louisiana: Breckenridge, IX, 16, 1915, (Rehn; juv. occasional in virgin long-leaf pine forest), 2 juv. ♀.

Florida: Pomona, IX, 7 and 8, 1917, (R. and H.; juv. not scarce on edge of marsh and in pine woods undergrowth), 3 ♂, 7 juv. ♂, 3 juv. ♀. Ocala, IX, 19 and 20, 1917, (R. and H.; juv. common, adults moderately numerous, undergrowth of sandy pine flat-woods), 9 ♂, 4 ♀, 4 juv. ♂, 10 juv. ♀. Dunellon, IX, 18, 1917, (R. and H.; few in area of short grass growing on damp sand), 1 juv. ♀. Tallahassee, IX, 2, 1915, (R. and H.), 6 juv. ♂, 1 juv. ♀. Woodville, IX, 1, 1915, (R. and H.; juv. occasional in long-leaf pine flat-woods), 4 juv. ♂, 1 juv. ♀. Carrabelle, IX, 2 and 3, 1915, (R. and H.; juv. moderate numbers in grasses of undergrowth of pine woods and in grasses and plants on edge of swampy areas), 1 juv. ♂, 3 juv. ♀. River Junction, VIII, 31, 1915, (R. and H.), 4 juv. ♂, 3 juv. ♀. Grand Ridge, IX, 1, 1915, (R. and H.; juv., undergrowth of pine woods), 1 juv. ♂, 2 juv. ♀. DeFuniak Springs, VIII, 30, 1915, (R. and H.), 4 juv. ♂, 2 juv. ♀. Pensacola, VIII, 29, 1915, (Hebard; one juv. in wire-grass of higher long-leaf pine woods), 1 juv. ♂.

Intermediates nearest *brevipenne brevipenne*

Florida: DeLeon Springs, IX, 8 and 9, 1917, (R. and H.), 1 ♂, 3 juv. ♂. Trilby, IX, 16, 1917, (R. and H.; occasional in pine woods undergrowth), 3 ♂, 3 ♀, 3 juv. ♂, 2 juv. ♀. Lakeland, IX, 11, 1917, (R. and H.; moderately numerous in pine woods undergrowth), 10 ♂, 7 ♀, 2 juv. ♂.

**Radinotatum brevipenne peninsulare** Rehn and Hebard (Plate IV, figure 9.)

1877. *Achurum brevipenne* Scudder, Proc. Bost. Soc. Nat. Hist., xix, p. 88. [Adults and juv.; Fort Reed, Florida.]

1888. *Achurum brevipenne* Comstock, Introd. Ent., p. 101. [Florida; Maryland (unquestionably in error).]

1902. *Rhadinotatum brevipenne* Rehn, Trans. Am. Ent. Soc., xxvii, p. 331. [♂, ♀; Miami, Florida.]

1905. *Rhadinotatum brevipenne* Caudell, Ent. News, xvi, p. 217. [Arcadia and Miami, Florida.]

1905. *Radinotatum brevipenne* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1905, p. 35. [Tampa and Miami, Florida.]

1912. *Radinotatum brevipenne peninsulare* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1912, p. 246, figs. 1, 3, 5, 7 and 9. [♂, ♀; Homestead, Miami, Fort Reed, Gotha, Tampa, Fort Capron and Chokoloskee, Florida.]

1914. *Radinotatum brevipenne peninsulare* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1914, p. 389. [♂, ♀, juv.; Homestead, Detroit and Big Pine Key, Florida.]

1914. *Radinotatum brevipenne peninsulare* Rehn and Hebard, Jour. N. Y. Ent. Soc., xxii, p. 103. [♂, ♀, juv.; Long Boat Key, Punta Gorda, Fort Myers, La Belle, Marco and Allen River to Deep Lake, Florida.]

1915. *Radinotatum brevipenne peninsulare* Hebard, Ent. News, xxvi, p. 402. [Miami, Florida.]

1916. *Radinotatum brevipenne peninsulare* Hebard, Ent. News, XXVII, p. 17. [Pineland on Pine Island, Charlotte Harbor, Florida.]

1920. *Radinotatum brevipenne* Blatchley, (in part), Orth. N. E. Amer., p. 197, fig. 74.

This geographic race is fully discussed in the original description and compared further with typical *brevipenne* under the treatment of that insect in the present paper.

The small size of the Big Pine Key series has already been commented upon. The series before us shows a still more important regional differentiation. The material from Miami to Homestead, on the East Coast, and from Big Pine Key, has the genicular angles of the caudal femora less elongate than is normal in typical *brevipenne*. The material from Fort Myers to Chokoloskee, on the West Coast, however, has these angles decidedly more elongate than in typical *brevipenne*, as would be expected in specimens showing more decided attenuation. This feature indicates a slight divergence of development in the race in the extreme southern portions of Florida, separated by the Everglades and the Bay of Florida.

Typical *peninsulare* appears adult throughout the year. Its habits and color phases are in every way similar to those of the more northern race. The typical condition has not been found north of the northern limits of the Caribbean Pine.

*Specimens Examined*, in addition to 319 previously recorded: 147; 86 males, 51 females and 10 immature individuals.

Atypical *brevipenne peninsulare*

FLORIDA: Kissimmee, IX, 10, 1917, (R. and H.; very abundant on wet "prairie", very grassy with an abundance of water-loving plants), 30 ♂, 19 ♀, 2 juv. ♂, 1 juv. ♀. Arcadia, IX, 12, 1917, (Rehn and Hebard; moderately common in undergrowth of long-leaf pine woods, largely wire-grass, saw-palmetto and bayberry), 12 ♂, 5 ♀, 1 juv. ♂, 2 juv. ♀.

Typical *brevipenne peninsulare*

FLORIDA: Fort Myers, IX, 13 to 15, 1917, (Rehn and Hebard: moderately common, generally distributed through wire-grass of the Caribbean Pine woods), 35 ♂, 21 ♀, 2 juv. ♂, 1 juv. ♀. Iona, Lee County, IX, 13, 1917, (Rehn and Hebard; generally distributed through pine woods), 2 ♂, 2 ♀. Boca Raton, III, 1, 1916, (Hebard; in field of scanty grass in sand region), 1 juv. ♂. Ojus, II, 29, 1916, (Hebard; undergrowth of Caribbean Pine forest), 1 ♀. Miami, II and III, (J. H. Comstock), 1 ♂, [Cornell Univ.]; III, 3, 1916, (Hebard; undergrowth of Caribbean Pine forest), 6 ♂, 3 ♀.

## PAPER TWO

### The Group Hyalopteryges as Found in the United States and Canada

A single species of this group is found in the area under consideration. This is *Truxalis brevicornis* (Johannson), the only species of the genus. The insect is a simple Hyalopterygine type, as shown by the general structure and particularly by the strikingly fenestrate wings of the male. The highest specialization in the group occurs in the South American genus *Hyalopteryx*. There are no other North American genera of the group, though *Thyriptilon* Bruner[1] and *Orphula* Stål,[2] species of both of which genera occur in Mexico, are aberrant Orphulellae showing convergence toward the Hyalopteryges in having the male wings strikingly fenestrate.

The genera of the Group Hyalopteryges now recognized are: *Hyalopteryx* Charpentier, *Eutryxalis* Bruner, *Truxalis* Fabricius and *Paratruxalis* Rehn. In linear arrangement of the North American genera, found north of Mexico, we place *Truxalis* after *Mermiria* and before *Syrbula*, which, of course, represent other genera groups.

The following characters are important in distinguishing this genus and species.

Head weakly ascending, its dorsal length shorter than that of the pronotum. Vertex roundly produced, a little longer than wide, showing a very weak medio-longitudinal carina; lateral foveolae weakly indicated, small, triangular, facing laterad; face rather strongly oblique. Pronotum with disk flattened, having distinct, straight, weak medio-longitudinal and lateral carinae; metazona nearly three-fourths as long as prozona; lateral lobes vertical, distinctly, but not decidedly, longer than deep. Tegmina and wings fully developed; the former obliquely truncate distad; the latter, in the male sex, with a fenestrate area as figured. Caudal femora with dorsal genicular lobes alone feebly produced, the internal very slightly

[1] Bruner's *Sisantum* is a synonym of *Thyriptilon*, as comparison of the types of the two genotypic species convincingly shows.

[2] The difficulties surrounding the proper application of this generic name have been eradicated by Rehn, Trans. Am. Ent. Soc., XLII, p. 275, (1916) and Idem, XLIII, p. 344, (1917).

the more so. Male supra-anal plate shield-shaped. Male subgenital plate elongate conical, its ventral length less than that of the preceding sternite.

**Truxalis brevicornis** (Johannson) (Plate IV, figure 10.)

1764. [*Gryllus*] *brevicornis* Johansson, Amoenit. Acad., VI, p. 398. [North America.]

1773. *Acrydium ensicornu* DeGeer, Mém. l'Hist. Ins., III, p. 499, pl. 42, fig. 7. [Pennsylvania.]

1861. *Ox*[*ycoryphus*] *burkhartianus* Saussure, Rev. et Mag. de Zool., XIII, p. 314. [♂, Mexico.]

1894. *Truxalis brevicornis* Beutenmüller, Bull. Amer. Mus. Nat. Hist., VI, p. 291, pl. VIII, figs. 1 and 2. [New York, New York.]

1896. *Tryxalis brevicornis* Morse, Psyche, VII, p. 383, pl. 7, figs. A, Aa and Ab.

1916. *Truxalis brevicornis* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1916, p. 155. (Discussion and many records from the southeastern United States.)

Though frequently appearing in the literature, the other records of this species add little but distributional data to those given above.

An average increase in size southward occurs in the species. Individuals from different localities in the same region, however, sometimes show very marked size difference. This is particularly demonstrated by males before us from Houston and Harrisburg, Texas.

Comparison of North American individuals with material from Mexico, Costa Rica, British Guiana, Brazil, Paraguay and Argentina shows no tendency whatever toward racial differentiation.

*Measurements (in millimeters) of average specimens and extremes*

| | Length of body | Length of vertex | Length of pronotum | Caudal width of pronotal disk | Length of tegmen | Length of caudal femur |
|---|---|---|---|---|---|---|
| ♂ | | | | | | |
| West Creek, N. J..... | 21.2 | 1.2 | 4.1 | 2.2 | 20.8 | 13.2 |
| Raleigh, N. C..... | 20.8 | 1.4 | 4.7 | 2.6 | 22.7 | 14.8 |
| Billy's Island, Ga.... | 26 | 1.4 | 5.4 | 2.8 | 27.2 | 17.7 |
| Fort Myers, Florida.. | 25 | 1.3 | 5.2 | 2.9 | 26 | 17.8 |
| Wolf Lake, Illinois... | 20.3 | 1.2 | 4.1 | 2.1 | 20.7 | 13.4 |
| Greenville, Alabama.. | 24 | 1.3 | 4.8 | 2.7 | 23.7 | 15.9 |
| Orleans Canal, La.... | 23.5 | 1.5 | 5.4 | 2.7 | 24.2 | 16.3 |
| Orleans Canal, La.... | 25.5 | 1.6 | 5.5 | 2.8 | 26.3 | 17.8 |
| Houston, Texas..... | 22.3 | 1.3 | 4.4 | 2.3 | 20.3 | 14.3 |
| Harrisburg, Texas.... | 25.9 | 1.4 | 5.2 | 2.8 | 25.8 | 16.6 |
| San Antonio, Texas.. | 27.2 | 1.7 | 5.8 | 2.8 | 26.4 | 17.7 |

| ♀ | Length of body | Length of vertex | Length of pronotum | Caudal width of pronotal disk | Length of tegmen | Length of caudal femur |
|---|---|---|---|---|---|---|
| Anglesea, New Jersey | 34 | 1.7 | 6.3 | 3.3 | 26.6 | 18 |
| Anglesea, New Jersey | 36.5 | 1.8 | 6.8 | 3.8 | 31 | 20.2 |
| Raleigh, N. C..... | 35 | 1.8 | 6.7 | 3.7 | 30.8 | 20.8 |
| Fort Myers, Florida.. | 39.3 | 1.8 | 7.3 | 3.9 | 32.8 | 23.3 |
| Everglade, Florida... | 39.5 | ... | 7.8 | ... | 38 | 25 |
| Wolf Lake, Illinois... | 31.5 | 1.4 | 5.8 | 3.3 | 25.4 | 18 |
| Orleans Canal, La.... | 45 | 2 | 7.8 | 4.3 | 37.4 | 23.7 |
| Harahan, Louisiana.. | 38.8 | 1.9 | 7.3 | 4.1 | 33.3 | 22 |
| Lake Charles, La.... | 43.5 | 2 | 8 | 4.7 | 39.3 | 23.2 |
| San Antonio, Texas.. | 43.2 | 2 | 8.2 | 4.2 | 37.7 | 24.2 |
| San Antonio, Texas.. | 43.7 | 2.1 | 8.8 | 4.7 | 37 | 26 |

Several distinct color phases are developed. Frequent individuals of both sexes are brown, this rarely dark in shade, the dorsal surface usually slightly paler. The majority of the males, however, are brown, with face, occiput, disk of pronotum, dorsal surface of tegmina and cephalic and median femora bright green. Frequent females are almost entirely green, often with a slender post-ocular streak of brown running along the lateral carinae of the pronotum and breaking into a series of dots on the tegmina. A few females are green, with dorsal surface buffy brown, this spreading distad on the tegmina to include all of their distal portion. The caudal tibiae are buffy brown, rarely green proximad in individuals showing that color strongly elsewhere.

The distribution of *brevicornis* in North America is now known to extend northward on the Atlantic Coast to New York City and Harrisburg, Pennsylvania, in Ohio and Indiana reaching the Great Lakes. In Canada it has been found at but one locality, Point Pelee, Ontario. The known western limits are Fond du Lac, Wisconsin; Wolf Lake, Illinois;[3] central Arkansas, and on the Gulf Coast of Texas as far inland as Houston, Burnet County, and San Antonio. Its range southward extends over much of continental America to Paraguay and Argentina.

[3] We can not give Bruner's record of "eastern Nebraska" recognition. No material of the species is in that author's collection from that state and his Nebraska list has been found to contain names of several other species which do not occur in Nebraska.

The species is a marsh dweller, preferring areas of cat-tails, high reeds and grasses. In such situations colonies are usually located by hearing a sharp and peculiar ticking sound, made by the males in flight. Individuals fly rapidly, usually curving quickly back into the vegetation from which they have been

Map 2. Showing distribution of *Truxalis brevicornis* (Johannson) in North America.

flushed, where they often cling high above the ground. So peculiar to such environment are they, that individuals will not be seen in the regions where the species is very abundant, unless the proper environment is visited. Like many semi-aquatic insects, *brevicornis* appears to have the habit of migrating from one favorable spot to another during the night.

In the extensive marshlands of southern peninsular Florida, and in the lowlands of the lower Mississippi region, this insect is, naturally, more generally encountered than elsewhere in the United States.

*Specimens Examined*, in addition to 156[4] previously recorded: 159; 84 males, 67 females and 8 immature individuals.

New Jersey: May's Landing, VIII, 29, 1914, (Hebard: common in small fresh-water marsh), 2 ♀. Tuckahoe, VIII, 26, 1914, (Hebard; in fresh-water marsh), 1 ♂, 5 ♀. Cedar Springs, VIII, 14, 1914, (Hebard; small colony in rushes of fresh-water marsh), 2 ♂, 1 ♀. Cape May Court House, VIII, 21, 1914, (Hebard; in cat-tails and rushes bordering salt-marsh), 1 ♀. Cape May, VIII, 18 to 31, 1917, (W. Stone), 12 ♂, 13 ♀, 1 juv. ♀, [A. N. S. P.].

North Carolina: Asheville, VIII, 1897, 2 ♂, 2 ♀, [Cornell Univ.].

Georgia: Dillard, Rabun County, 2200 feet, IX, 4, 1917, (R. and H.; numerous colony in swampy spot, covered with low weeds), 3 ♂, 3 ♀, 1 juv. ♀. Billy's Island, Okeefenokee Swamp, VII, 16 to 19, 1917, (Hebard; in swamp vegetation on edge of lake), 1 ♂.

Florida: Fort Myers, IX, 13 to 15, 1917, (R. and H.; one small colony in "hammock" undergrowth), 3 ♂, 1 ♀.

Ohio: Columbus, (Wood), 1 ♀, [Hebard Cln.].

Indiana: Kosciusko County, VIII, 11, 1902, (W. S. Blatchley), 1 ♀, [Hebard Cln.]. Vigo County, IX, 18, 1894, (W. S. Blatchley), 1 ♂, [Hebard Cln.].

Wisconsin: Fond du Lac, (Mitchell), 1 ♂, [Hebard Cln.].

Illinois: Wolf Lake, near Havana, IX, 10, 1898, 1 ♂, 1 ♀, [Hebard Cln.].

Tennessee: Chattanooga, (B. Shimek), 1 ♂, 2 ♀, [Hebard Cln.].

Alabama: Opelika, VIII, 2, 1915, (Hebard; moderate numbers everywhere in marshy areas), 1 ♀, 1 juv. ♂. Montgomery, IX, 8, 1915, (R. and H.; common in marshy river bottom areas), 2 ♂, 2 ♀. Greenville, Butler County, VIII, 3, 1915, (Hebard), 4 ♂, 1 ♀. Evergreen, Conecuh County VIII, 4, 1915, (Hebard; moderate numbers in marshy area), 2 ♂. Flomaton, Escambia County, VIII, 27, 1915, (R. and H.; moderately large colony in grasses of opening in "branch"), 2 ♂, 1 ♀.

Mississippi: Meridian, IX, 10, 1915, (R. and H.; locally common in marshy areas in bottom), 2 ♂, 3 ♀. Winona, IX, 15, 1915, (Hebard; in grasses bordering slough), 1 ♂, 1 ♀.

Louisiana: Arcadia, VIII, 20, 1915, (R. and H.), 1 ♂. Spanish Fort, Orleans Parish, VIII, 5 to 7, 1915, (R. and H.; common in high grass marsh bordering Lake Pontchartrain), 7 ♂, 4 ♀. Orleans Canal, near Spanish Fort, Orleans Parish, VIII, 6 and 7, 1915, (R. and H.; very common in high marsh grass), 5 ♂, 4 ♀. New Orleans, VI, 29, 1916, (Rehn), 1 ♂, [A. M. N. H.]; VIII, 6, 1915, (R. and H.), 1 ♂, 1 ♀. Harahan, Plaquemines Parish, VIII, 7, 1915, (R. and H.; one in short grass of levee, one in heavy willow swamp bordering river), 2 ♀. Rhoda, St. Mary Parish, VIII, 8, 1915, (R. and H.; common in swampy areas about small pond), 1 ♂. Morgan City, VIII, 8, 1915, (R. and H.; everywhere common in swamp vegetation), 5 ♂, 6 ♀. Lafayette, VIII, 9, 1915, (R. and H.; swamp grasses near bayou), 1 ♂, 1 juv. ♀. Lake Charles, VIII, 10, 1915, (R. and H.; common in marshy areas, two seen at light at night), 1 ♀, 1 juv. ♀.

[4] Of these, sixty-eight are from localities ranging from Mexico south to Argentina.

Texas: Beaumont, VII, 23, 1912, (Hebard; occasional in tangles of weeds in forest), 3 ♂, 2 ♀. Nome, Jefferson County, VI, 30, 1916, (Rehn; attracted to light on train after dark), 1 ♂. Houston, VIII, 12, 1915, (R. and H.), 1 ♂, 1 juv. ♂. Harrisburg, Harris County, VIII, 13, 1915, (R. and H.; common in flag-like, saw-edged grass near stream), 2 ♂. Dickinson, Galveston County, VII, 20, 1912, (Hebard; scarce in tall green plants near stream in pine woods), 2 ♂, 1 ♀, 2 juv. ♀. Burnet County, X, 1884, (F. G. Schaupp), 1 ♀, [Hebard Cln.]. San Antonio, VIII, 16, 1912, (R. and H.; San Antonio river bottom, common in rank, high, green grasses and nettles), 13 ♂, 3 ♀.

## Explanation of Plate IV

Fig. 1.—*Achurum sumichrasti* (Saussure). Fort Grant, Arizona. Male. Dorsal view of tegmen and wing. (× 1½)

Fig. 2.—*Achurum sumichrasti* (Saussure). Fort Grant, Arizona. Male. Lateral view of distal portion of abdomen. (× 8)

Fig. 3.—*Achurum sumichrasti* (Saussure). Fort Grant, Arizona. Male. Dorsal view of distal extremity of dextral caudal tibia. (Much enlarged.)

Fig. 4.—*Achurum sumichrasti* (Saussure). Orizaba, Vera Cruz, Mexico. Immature male. Lateral view of distal portion of abdomen. A. Supra-anal plate. B. Tergite beyond supra-anal plate, which in the adult disappears. C. Cercus. D. Subgenital plate. (× 8)

Fig. 5.—*Radinotatum minimipenne* (Caudell). Piper Plantation, near Brownsville, Texas. Male. Lateral view. (× 2½)

Fig. 6.—*Radinotatum minimipenne* (Caudell). Piper Plantation, near Brownsville, Texas. Male. Lateral view of distal portion of abdomen. (× 8)

Fig. 7.—*Radinotatum minimipenne* (Caudell). Piper Plantation, near Brownsville, Texas. Male. Dorsal view of distal extremity of dextral caudal tibia. (Much enlarged.)

Fig. 8.—*Radinotatum brevipenne brevipenne* (Thomas). Pomona, Florida. Male. Lateral view of distal portion of abdomen. (× 8)

Fig. 9.—*Radinotatum brevipenne peninsulare* Rehn and Hebard. Homestead, Florida. Male (*type*). Lateral view of distal portion of abdomen. (× 8)

Fig. 10.—*Truxalis brevicornis* (Johannson). Fort Myers, Florida. Male. Dorsal view of tegmen and wing. (× 2)

# ON THE MALE GENITALIA OF THE LARGER HESPERIIDAE OF NORTH AMERICA

BY HENRY SKINNER AND R. C. WILLIAMS, JR.

It is now generally conceded that in some of the groups of butterflies the male genitalia offer characters of very great importance in classification. This was recognized as applying particularly to the Hesperiidae by Godman and Salvin, who, in the Biologia Centrali-Americana, give many excellent figures of the Central American species, including many of those which find their way into our fauna across the Mexican border. It is our object in this paper to present figures of all the larger North American species of which we have available material.

The Biologia, an unusually carefully prepared and scientifically correct publication is, however, not available to the average student as the parts were not sold separately, and the three volumes dealing with the Rhopalocera are now quoted separately at a very high price. For this reason, and because the details of the aedoeagus were omitted, we are again figuring the Biologia species, although the correctness and excellence of these figures commands our highest praise.

Dyar in 1905[1] reviewed the Hesperiidae, generally adopting Scudder's classification; Skinner in 1911[2] contributed to our knowledge of our larger species, and Lindsey's valuable paper of 1921[3] is the basis for our work, which covers the single species in the sub-family Pyrrhopyginae and Group A of Dyar and Lindsey in the Hesperiinae.

Scudder in his "Butterflies of Eastern United States and Canada" has figured in volume III, plate 35, the male genitalia of five of the species of this group coming within the territory covered by him.

The genitalia were prepared by separating the tegumen, valvae and aedoeagus, and mounting them separately on slides;

[1] Jour. N. Y. Ent. Soc., XIII, p. 111, 1905.
[2] Trans. Am. Ent. Soc., XXXVII, p. 169.
[3] Univ. of Iowa, Studies Nat. Hist., IX, no. 4.

sketches were made directly from these as they lay under the cover glass. There is distortion of course, but, as the general shape and the relationship of the parts in life is well known, we believe this to be the best method for this group. Only the chitinous parts were outlined and hairs and other vestiture are omitted.

In regard to the classification followed, we are frankly opposed to the splitting up of the older blanket genera, believing that substantial scientific characters only should be used in such separations, and that the utilitarian value of the generic name should not be lost sight of. We have followed Lindsey in many of his conclusions, but prefer to retain for the present the older conception of the genus *Eudamus*, and unite *Achalarus*, *Thorybes*, *Cogia* and *Phoedinus* under the oldest name, *Cogia*, for while in some instances the genitalic characters in the species tend to confirm his conclusions, in other cases the reverse is true, and we are of the opinion that male secondary characters, such as the costal fold and wing and tibial tufts, have specific value only.

We have thirty-seven species attributed to our fauna, of which three are doubtful and eight are Central American species with a single record of capture over the border.

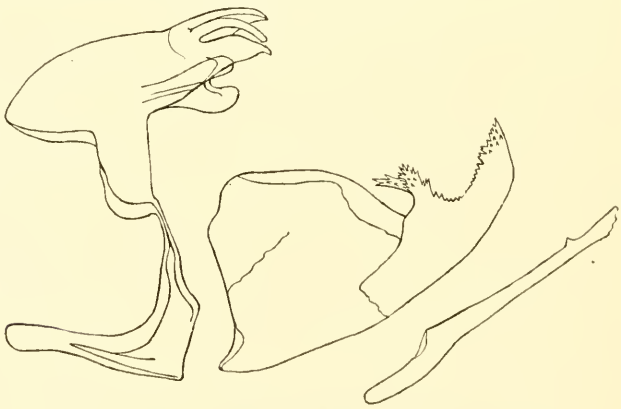


Fig. 1. *Apyrrothrix araxes arizonae.* Mount Graham, Arizona.

## Pyrrhopyginae

1. **Apyrrothrix araxes arizonae** Godman and Salvin (Fig. 1.)

The genus has been erected by Lindsey for this species. The male genitalia of the typical Mexican form figured in the Biologia[4] is practically the same as that of the Arizona race. There is a tooth towards the extremity of the aedoeagus. The third central projection in the uncus, present in the allied genera, more or less developed, is typical of this group.

## Hesperiinae

2. **Phocides batabano** Lucas (Fig. 2.)

The third long central projection in the uncus with its curious beaked terminus is typical of this genus, and the scaphium is absent as in most of the other species. The aedoeagus is provided internally with a number of candle-shaped teeth and the external end is shagreened.

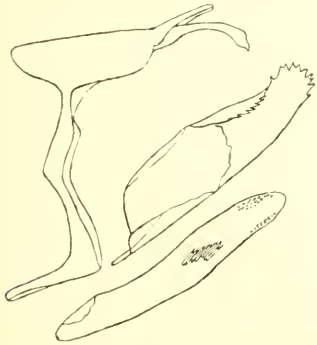


Fig. 2.

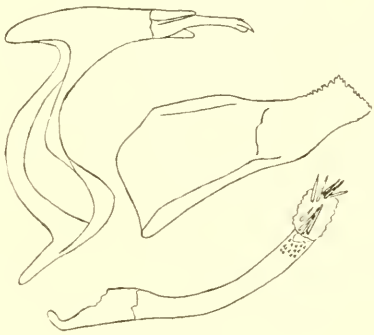


Fig. 3.

Fig. 2. *Phocides batabano.* Cuba.

Fig. 3. *Phocides lilea.* Honduras.

3. **Phocides lilea** Reakirt (Fig. 3.)

Biologia, pl. 76, fig. 24.

There is a specimen in the Academy collection, agreeing with the figure in the Biologia, which came to Dr. Skinner from Dr. Scudder, bearing the label "Type *sanguinea*, Texas, Pope Exp." Scudder had this insect before him when he described the

[4] Plate 73, fig. 16.

species under the latter name in "A systematic review" etc., published in the Fourth Annual Report of the Trustees of the Peabody Academy of Science for the year 1871, printed in Salem, Massachusetts, 1872, pages 24 to 83; and we select this specimen, a male, as the type of *sanguinea* Scudder, falling to *lilea* Reakirt. We have the species from Alahuela, Costa Rica, (Harrower).

4. **Phocides urania** Westwood-Hewitson.

There is a male specimen in the Academy Collection labelled by Scudder "*Texana* Type." It agrees with the Biologia figure of *urania*, but does not agree with his description of *texana* in the paper referred to above, which may, however, have been based on a worn female. As both (*urania* and *texana*) are recorded as obtained from the Pope Texas Boundary Expedition, they may have been caught in the same locality and not recognized by Scudder as male and female of the same species, until after the description of the *texana* had been published.

5. **Nascus hesus** Westwood-Hewitson (Fig. 4.)

This is another species included in our fauna through Scudder's record "Texas, Pope, Mexican Boundary Survey" in the same publication. Of course all of these records are doubtful, as the survey covered both sides of the Rio Grande, and it is probable

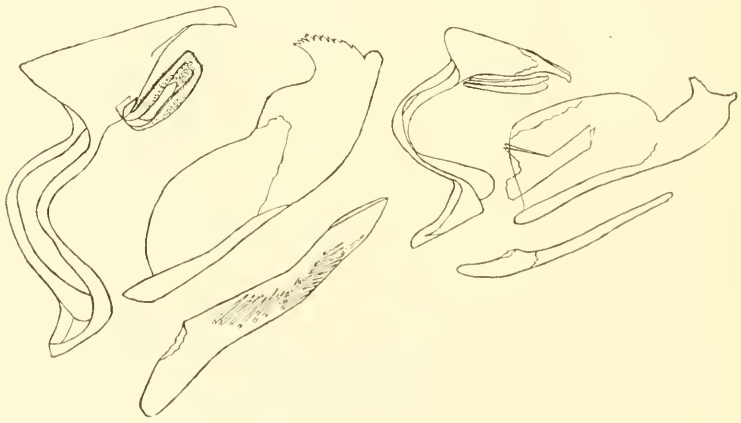


Fig. 4. Fig. 5.

Fig. 4. *Nascus hesus.* Fig. 5. *Polygonus amyntas arizonensis.* Florence, Arizona.

that the insects collected were brought in by interested natives and may have come from some distance. None of the three have been captured north of the river since the date of their description (1871).

The females in this group are remarkably dissimilar from the males. *Euribates* Cramer is a female, and Skinner followed Godman and Salvin, who in the Biologia, sunk the name *hesus* under *euribates*. However, it is perhaps best to use the former name until the two sexes are definitely proved to be those of the same species. The male genitalia show a single shagreened scaphium, and the aedoeagus includes numerous floating spines.

6. **Polygonus amyntas arizonensis** Skinner (Fig. 5.)

Typical *amyntas*, Biologia, pl. 77, fig. 9.

There is no difference in the male genitalia between the typical Florida and Arizona forms.

The uncus terminals are bifid, two long arms of scaphium shagreened at terminus, aedoeagus slender and naked and this species has a well developed juxta which may act as a support for the last.

The type and paratypes of *arizonensis* are in the Academy Collection, (Florence, Arizona; Biederman).

7. **Proteides idas** Cramer (Fig. 6.)

Biologia, plate 77, fig. 5.

The scaphium is somewhat shagreened above and the aedoeagus contains two short candle-shaped spines.

Fig. 6.

Fig. 7.

Fig. 6. *Proteides idas*. Yucatan. Fig. 7. *Epargyreus zestos*. Key West, Florida.

8. **Epargyreus zestos** Geyer (Fig. 7.)

In addition to Miami and Key West examples in the Academy Collection, there are some from the Bahamas.

In this and the following species of this genus, the aedoeagus is ragged and dentate at its terminus and slightly shagreened.

The conspicuous central costal projection on the valves bearing rather long stout spines readily separates the species of this genus from those of *Proteides*.

9. **Epargyreus tityrus** Fabricius (Fig. 8.)

The male genitalia are very close to those of the preceding and following species which, however, are readily separated by their color and maculation.

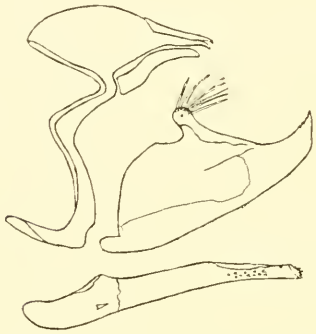


Fig. 8.

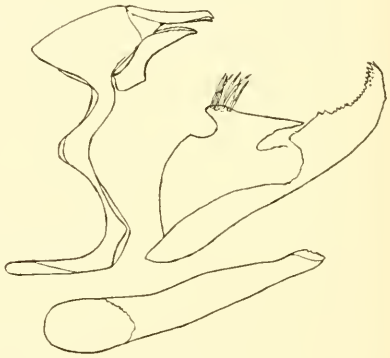


Fig. 9.

Fig. 8. *Epargyreus tityrus*. Cloudcroft, New Mexico. Fig. 9. *Epargyreus exadeus*. Chapada, Brazil.

10. **Epargyreus exadeus** Cramer (Fig. 9.)

Biologia, Plate 75, fig. 5.

We have specimens from San Luis Obispo, California, March.

11. **Eudamus (Goniurus) proteus** Linnaeus (Fig. 10.)

Biologia, plate 75, fig. 5.
Scudder, fig. 37.

The genus *Eudamus* was erected by Swainson in 1832 with *proteus* as type. *Goniurus* was erected by Hubner in 1820 for *simplicius*, *coelus*, *proteus* and six other species. Watson in 1893 selected *coelus* Cramer (*aurunce* Hewitson) as type of

*Goniurus*, and is followed by Godman and Salvin in the Biologia, who place with it *talus*, a similar untailed hesperid, but with the generic distinction from *Eudamus* open to question. Lindsey puts *simplicius* as the type of *Goniurus*, presumably as the first mentioned species. Now if *coelus* is declared congeneric with the tailed hesperids now usually included under *Eudamus*, the latter name must fall for the former, but if the contrary obtains, *Goniurus* should be confined to *coelus* and *talus*, neither coming in our fauna, and *Eudamus* still holds for the considerable group of tailed skippers headed by *proteus;* the writers are inclined to follow this course.

The male genitalia with its cleft uncus, conspicuous but simple scaphium and rather normal clasp, may be called typical of this entire group of the Hesperiidae. The aedoeagus contains a stout, many-branched spine.

A very closely related species, *esmeraldus*, very difficult to distinguish from its color and maculation, has a very different terminus to its valve.

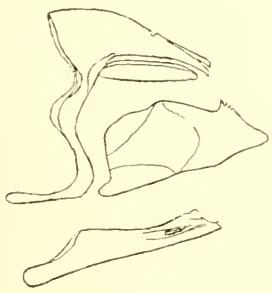


Fig. 10.

Fig. 11.

Fig. 10. *Eudamus* (*Goniurus*) *proteus*. Miami, Florida. Fig. 11. *Eudamus* (*Goniurus*) *dorantes*. Gatun, Canal Zone, Panama.

12. **Eudamus (Goniurus) dorantes rauterbergi** Skinner (Fig. 11.)

Typical *dorantes* Biologia, plate 75, fig. 7.

This species has a wide range to the south from our border, and is subject to considerable variation in series from any locality. *Rauterbergi*, the type of which is in the Academy

Collection, represents the small dark form *santiago*, from Cuba, and a similar form, though still darker, from Porto Rico (Williams) are the insular representatives of *dorantes*.

The tegumen is typical, valve with flat toothed extremity cleft deeply on costal extremity and the aedoeagus carries a long, stout, curved spine.

13. **Eudamus simplicius** Stoll (Fig. 12.)

Biologia, plate 75, fig. 1.

We have this species from Guatemala (Rhoads); Canal Zone, Panama (Harrower); Vera Cruz, Mexico (Williams), and Texas (Aaron).

The male genitalia of this and the following species are almost identical. The aedoeagus carries a long slender spine, and the tip of the valve is rounded with a projecting tooth curiously like a bird's head and beak.

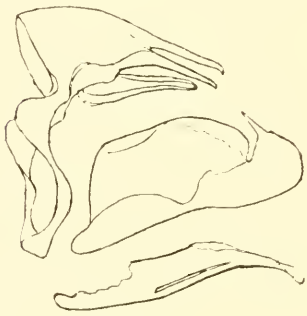


Fig. 12.

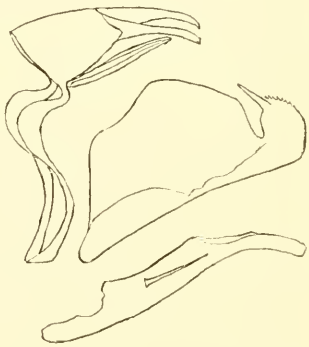


Fig. 13.

Fig. 12. *Eudamus simplicius*. Puerto Barrios, Guatemala. Fig. 13. *Eudamus eurycles*. Puerto Barrios, Guatemala.

14. **Eudamus eurycles** Latreille (Fig. 13.)

This species is without the costal fold present in the male of that above, and the hyaline band is conspicuous. We have it from Guatemala (Rhoads); Bocas del Toro, Panama (Williams) and other Central American localities, including Colima, Mexico. Skinner's record is undoubtedly correct, as most of the species recorded in the list in 1901 have since been confirmed by subsequent captures.

15. **Eudamus (Chioides) albofasciatus** Hewitson (Fig. 14.)

Biologia, plate 75, fig. 11.

Lindsey places this and the following species in a genus he erects for them, based on characters which may or may not be of sufficient importance to warrant this action. We are inclined to deplore the splitting up of the older genera in general, and as we do not find important characters in the male genitalia to support this separation, prefer to retain these species in the genus *Eudamus*.

In this and the following, the scaphium is shagreened, aedoeagus simple and the principal differences are confined to the shape of the valve, especially its terminal structure, these having strong specific but little generic value.

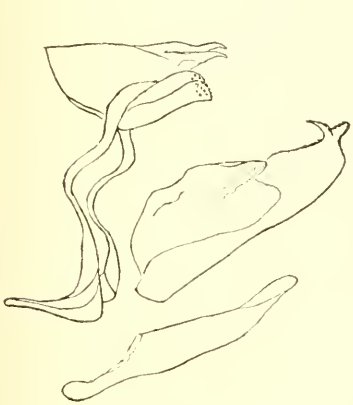


Fig. 14.

Fig. 15.

Fig. 14. *Eudamus (Chioides) albofasciatus*. Vera Cruz, Mexico. Fig. 15. *Eudamus (Chioides) zilpa*. Unknown locality.

16. **Eudamus (Chioides) zilpa** Butler (Fig. 15.)

Biologia, plate 75, fig. 8.

A striking species, the under side of the male being well figured in Lindsey's paper.

17. **Eudamus alcaeus** Hewitson (Fig. 16.)

Biologia, plate 75, fig. 12.

We have specimens from Huigra, Ecuador (Rhoads), and Williams has caught it in Vera Cruz, Mexico. It is another species entering our fauna through the Runyeon capture, which is authentic.

The male genitalia show a highly developed shagreened scaphium, the cleft uncus terminals show a tendency only to the short and spatulate condition obtaining in the following species (*melon*), and the aedoeagus carries a branched spine similar to that of *proteus*. We prefer to leave this species in *Eudamus*.

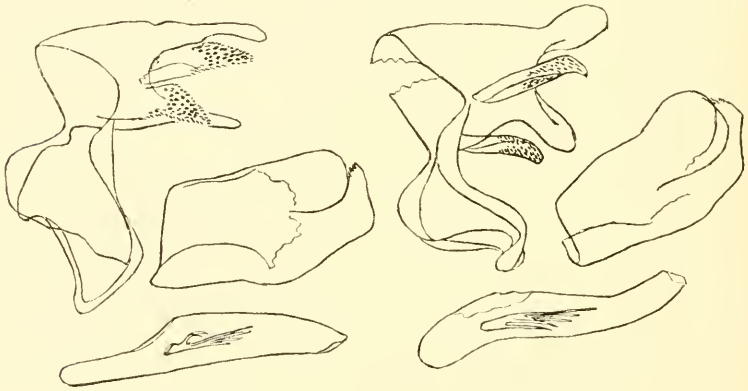


Fig. 16. Fig. 17.

Fig. 16. *Eudamus alcaeus*. Huigra, Ecuador. Fig. 17. *Codatractus melon arizonensis*. Baboquivari Mountains, Arizona.

18. **Codatractus melon arizonensis** Skinner (Fig. 17.)

The type and paratypes of the Arizona form (Poling) are in the Academy Collection.

The male genitalia show, as indicated above, comparatively short, widely separated spatulate terminal projections to the uncus. The aedoeagus carries a branched spine, which has the forks leaving the stalk rather lateral than distal.

19. **Telegonus hahneli** Staudinger

This is another species recorded in our fauna through the Runyeon catch. The identification was made from the Godman and Salvin figure in the Biologia, which differs from the Staudinger figure in the absence of the yellowish outer border of the wings, and the shape of the secondaries, which are rounded in the former and with a projecting anal angle in the latter.

The type of *hahneli* is from Merida, Venezuela, but Staudinger mentions, in the description, having specimens from Chiriqui, Panama. It is possible that two species are involved, and that Godman and Salvin had before them a Chiriqui specimen instead of the Venezuela type, and so identified it with their own Chiriqui and Costa Rican material.

We have specimens from Jamaica and the Island of St. Thomas.

Fig. 18. Fig. 19. Fig. 20.

Fig. 18. *Plestia dorus*. Jemez Hot Springs, New Mexico. Fig. 19. *Cecropterus cellus*. Mount Graham, Arizona. Fig. 20. *Cecropterus pseudocellus*. Ramsay Canyon, Huachuca Mountains, Arizona.

20. **Plestia dorus** Edwards (Fig. 18.)

There is a specimen in the Academy Collection from the type catch. *Dorus* has the normal cleft uncus projections and the aedoeagus contains a stout branched spine.

21. **Cecropterus cellus** Boisduval and Leconte (Fig. 19.)
Biologia, plate 89, fig. 8.

This species has a normal tegumen, but the general shape of the valvae is quite different in plan from that obtaining in the preceding and following genus. The aedoeagus is long and slender and carries a pair of slender connected spines.

22. **Cecropterus pseudocellus** Coolidge and Clemence (Fig. 20.)

There are cotypes in the Academy Collection, and a specimen from Real del Monte, Hidalgo, Mexico, April 13, 1908. These have the pale ring at the base of the antennal club mentioned by Lindsey.

23. **Cogia (Achalarus) lycidas** Abbott and Smith (Fig. 21.)
Scudder, fig. 44.

Fig. 21.

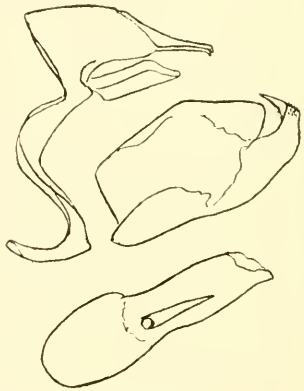


Fig. 22.

Fig. 21. *Cogia* (*Achalarus*) *lycidas*. Unknown locality. Fig. 22. *Cogia* (*Achalarus*) *epigona*. Arizona.

24. **Cogia (Achalarus) epigona** Herrich-Schaeffer (Fig. 22.)
Biologia, plate 80, fig. 11.

The male genitalia of these two species are almost identical.

25. **Cogia (Achalarus) albociliata** Mabille (Fig. 23.)

Biologia, plate 80, fig. 14.

We have specimens of this from Alta Mira, Mexico, August 14, and San Pedro Sula, Honduras, January 5, 1922, (Lienhart), which agree with the Godman and Salvin figures. The male genitalia are very similar to those of the two species above, even in the shape of the valve terminus, though in this character it differs remarkably from the following species, with which it has been associated since 1905. It is doubtful if this species enters our fauna, as the records probably apply to the following species.

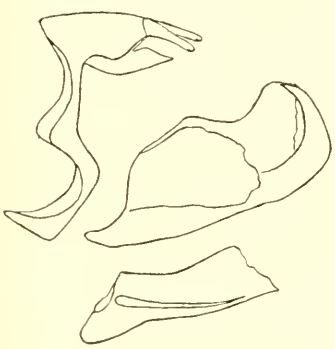


Fig. 23.

Fig. 24.

Fig. 23. *Cogia* (*Achalarus*) *albociliata*. San Pedro Sula, Honduras. Fig. 24. *Cogia coyote*. Corpus Christi, Texas.

26. **Cogia coyote** Skinner (Fig. 24.)

This species, described from southern Texas near Corpus Christi, (Aaron), is represented in the Academy Collection by the types and a paratype from which the genitalia is figured.

In appearance they differ from *albociliata* in slightly smaller size, much lighter color, *coyote* being brown and *albociliata* almost black above, the fringe is not so white, the markings on the secondaries below in *coyote* are of a darker brown than the ground color, while in *albociliata* they are somewhat lighter than the ground color, but outlined in a darker shade.

The male genitalia differ from those of the previous species in the very much shorter terminals to the uncus, as well as the very remarkable difference in the valves.

The records of *albociliata* by Dyar from the Patagonia Mts., Arizona, (Oslar), and Kerrville, Texas, and Leussler's Beeville, Texas, October 16, 1916, (Patty Hutchinson), probably apply to this species.

27. **Cogia (Thorybes) drusius** Edwards

The two specimens in the Academy Collection are from the type catch. The Lindsey record "Western Nebraska" is an error, as Mr. Leussler has had nothing like it from that locality.

28. **Cogia (Thorybes) pylades** Scudder (Fig. 25.)

Biologia, plate 80, fig. 23.
Scudder, fig. 35.

The type of the aberration *immaculata* Skinner is in the Academy Collection.

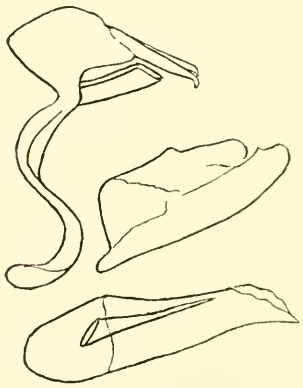


Fig. 25.

Fig. 26.

Fig. 25. *Cogia (Thorybes) pylades.* Avon, Connecticut. Fig. 26. *Cogia (Thorybes) bathyllus.* Philadelphia, Penna.

29. **Cogia (Thorybes) bathyllus** Abbott and Smith (Fig. 26.)

Scudder, fig. 38.

Lindsey in using the name *daunus* Cramer follows Dyar, who in turn perhaps follows a reference in Godart, Encyclopedie

Méthodique.[5] Godart says *bathyllus* approaches *daunus* in appearance. From the Cramer figure of *daunus* it is doubtfully possible to identify the species, which may be an unidentified Surinam insect. *Bathyllus* appears to be confined to America north of Mexico, as it has not been recorded in the Biologia.

The figure of *bathyllus* in Abbott and Smith's Insects of Georgia is excellent, and it seems unwise to place it as a synonym of *daunus* without additional evidence.

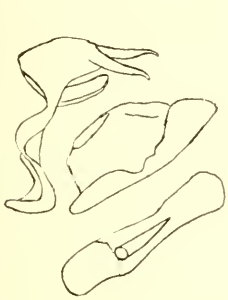


Fig. 27.

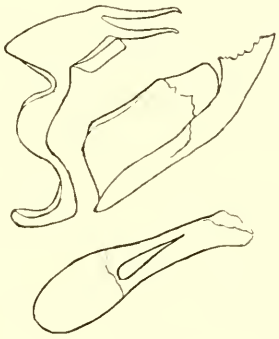


Fig. 28.

Fig. 27. *Cogia* (*Thorybes*) *mexicana*. Uruapan, Michoacan, Mexico. Fig. 28. *Cogia* (*Thorybes*) *nevada*. Mono Lake, California.

30. **Cogia (Thorybes) mexicana** Herrich-Schaeffer (Fig. 27.)

Biologia, plate 80, fig. 17.

We have this species from Uruapan, Mexico, April 15, 1919; Popocatepetl Park, Mexico, September 17, 1906 (Calvert), and Real del Monte, Hidalgo, Mexico, August 40, 1908 (Van Nostrand). We believe that the male genitalia, however, warrant its separation from *nevada* Scudder (*aemelia* Skinner). The tegumen and aedoeagus are alike, but the extremity of the valve in *mexicana* is somewhat convex and slightly serrate, while that of *nevada* is concave or well cut into with a rounded excavation, and the serrations or teeth are much stronger. *Mexicana* probably does not enter our territory.

[5] x, p. 764, 1823.

31. **Cogia (Thorybes) nevada** Scudder (Fig. 28.)

The types of *aemelia* are in the Academy Collection. We have typical *nevada* from Fort Klamath, Oregon, June 6 to 18; Lundy, California, July 9 (Wickham); Deer Park, Placer Co., California, July 11, 1908; Cloudcroft, New Mexico, May 7 to 26 and July 27 (some dark individuals); Jemez Springs, New Mexico, July 21 (Woodgate), and Colorado.

A darker form, in which also the hyaline spots are not so large, we have from Mt. Graham, Arizona (Morrison); Park City, Utah, July 6, 1895, and Silver Lake, Utah, July 13 (Skinner). This is the form that has been considered *mexicana* in collections. We have intermediate forms from City Creek Canyon, Utah, July 17, 1898, and Sierra la Sal Mts., Utah, July 25, 1920 (Skinner).

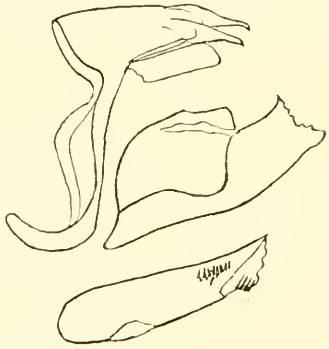


Fig. 29.

Fig. 30.

Fig. 29. *Cogia* (*Thorybes*) species. Summerville, South Carolina. Fig. 30. *Cogia calchas*. Texola, Vera Cruz, Mexico.

32. **Cogia (Thorybes)** species (Fig. 29.)

This species will be described by Mr. E. L. Bell on a subsequent page of this volume of the TRANSACTIONS.

The present species is in the Academy Collection from Tampa, Florida, March 19, (Bell); Wilmington, North Carolina, April 25; Tallulah Falls, Georgia, July 7; Summerville, South Carolina (Jones), and Round Mountain, Blanco County, Texas, determined genitalically.

While the general appearance of this insect has lead to its confusion with *pylades* in collections, in addition to the absence of

the costal fold, the male genitalia are quite different from both *pylades* and *bathyllus* in the shape of the valve, and the fact that the aedoeagus is as in the subgenus *Phoedinus*, instead of a single thorn present, as in the balance of the species of the *Thorybes* group which we have examined.

It does, however, agree with the others of the *Thorybes* group in that the terminus of the uncus is bifurcate.

33. **Cogia calchas** Herrich-Schaeffer (Fig. 30.)

Biologia, plate 81, fig. 6.

This species has an extended range from Texas into South America. We have it from Brazil, Mexico, Colombia and Colon, Panama, February 19, 1912, (Williams).

The aedoeagus of this and the two following species encloses numerous short spines.

34. **Cogia outis** Skinner (Fig. 31.)

The types from Texas are in the Academy Collection. The terminus of the uncus of this species, the two following and *caicus* is not split, but on the contrary there is a similar single beaked terminus as though the double ends were fused together.

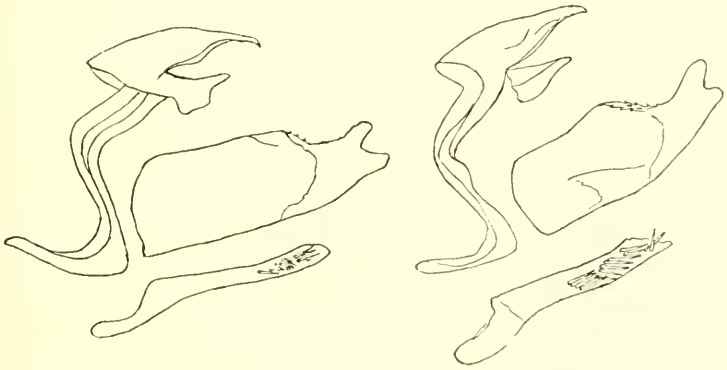


Fig. 31. Fig. 32.

Fig. 31. *Cogia outis*. Round Mountain, Texas. Fig. 32. *Cogia hippalus*. Baboquivari Mountains, Arizona.

35. **Cogia hippalus** Edwards (Fig. 32.)
Biologia, plate 80, fig. 31.

There are specimens from the type locality—Arizona (Morrison, 1882)—probably of the type catch, and from Colima, Mexico.

The male genitalia of this and the above species are very close.

36. **Cogia (Phoedinus) mysie** Dyar

This species is not represented in the Academy Collection and we are not familiar with it.

37. **Cogia (Phoedinus) caicus** Herrich-Schaeffer (Fig. 33.)
Biologia, plate 80, fig. 20.

There is a series in the Academy Collection from Arizona (Morrison), the locality from which Edwards received the material upon which his *moschus* was described.

The general appearance and maculation of this species is very similar to that of the species of the *Thorybes* group, and the male genitalia are very close in their characters to those of the group above.

Fig. 33.

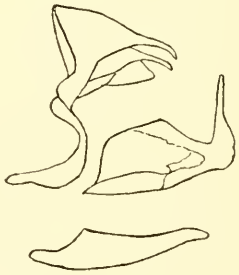


Fig. 34.

Fig. 33. *Cogia (Phoedinus) caicus.* Mount Graham, Arizona. Fig. 34. *Cabares potrillo.* Jamaica.

38. **Cabares potrillo** Lucas (Fig. 34.)

Biologia, plate 80, fig. 26.

There are examples in the Academy Collection from Mexico, Cuba, Haiti, San Domingo, Jamaica and Tortuga. The shape of the secondaries, as well as of the male genitalia with its peculiar valve and nude aedoeagus, seems to well separate it from the previous group.

The terminus of the uncus is strongly bifurcate, the aedoeagus is simple without spines or other attachments, and the valve terminates in a long spine somewhat serrate externally, and which in nature is bent back towards the base.

# NOTES ON A FEW INTERESTING BLATTIDAE FROM GUATEMALA, WITH THE DESCRIPTION OF A NEW SPECIES

(ORTHOPTERA)

BY MORGAN HEBARD

## Pseudomopinae

**Anisopygia jocosicluna** Saussure

1893. *A[nisopygia] jocosicluna* Saussure, Soc. Ent., Zurich, VIII, p. 57. [[♂], Guatemala.]

Vicinity of Guatemala City, 1 ♀, [Hebard Cln.].

At the time Saussure and Zehntner described and figured the male sex, recording it from Capetillo, Guatemala, those authors described *Temnopteryx guatemalae*[1] from a female and numerous immature individuals taken in Guatemala City. It appears more than probable that the opposite sexes of one species were represented, but in the absence of a series representing both sexes we are not able to establish definitely this synonymy.

We believe the female before us to represent *jocosicluna*, though it agrees with the female of *guatemalae* as described. The supra-anal plate is minutely incised mesad, but is subchitinous medio-longitudinally from that point to near its base. Length of body, 10.2; length of pronotum, 3; width of pronotum, 4; length of tegmen, 3.1 mm.

**Chromatonotus agunae** new species (Text figures 1, 2 and 3.)

This species is closely related to *C. lamprus* Hebard, agreeing rather with *C. notatus* (Brunner) only in the slightly broader pale cephalic margin of the pronotum. The male genitalia are distinctive.

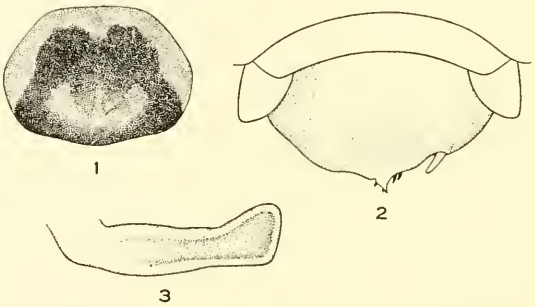
*Type.*—♂; Aguna, Department of Escuintla, Guatemala. Elevation, 650 meters. [Hebard Collection, Type no. 863.]

This specimen shows all the generic features originally described,[2] in addition we note the following. Size small, form slender, much as in *lamprus*.

[1] Biol. Cent.-Amer., Orth., I, p. 53, (1893).

[2] Mem. Amer. Ent. Soc., no. 4, p. 45, (1920).

Interocular width slightly over three-quarters that between antennal sockets, as in that species.[3] Supra-anal plate weakly transverse, length slightly over half proximal width, free margins nearly straight, convergent to weakly bilobate distal portion, which is less strongly chitinous and is supplied with long hairs. Cerci small, elongate and slender (having eleven joints), the sutures well marked, the dorsal surface flat; generally as in *lamprus*. Concealed genitalia as follows. From the base of the sinistral cercus an elongate, somewhat irregular, chitinous finger extends two-thirds the distance across the anal chamber, expanding slightly dorsad at its rounded apex, its caudal surface moderately concave throughout.[4] Subgenital plate rather strongly convex except in small meso-distal area, where it is weakly concave; surface supplied with elongate scattered hairs; free margins evenly convergent and showing very slight convexity to median fourth, which section is symmetrically trapezoidal with angles rounded. Sinistral style situated at base of




*Chromatonotus agunae* new species. Fig. 1. Dorsal view of pronotum. Fig. 2. Ventral view of subgenital plate. Fig. 3. Caudal view of concealed sinistral genital process. (All much enlarged.)

this median and produced portion, minute, simple, cylindrical, very feebly tapering to the rounded apex, about three times as long as its basal width. Dextral style situated at dextral angle of produced portion, minute, rounded, conical, slightly longer than broad, terminating in a minute but stout spine, which is slightly decurved, the dorsal surface of the style occupied by a similar, but smaller, spine, while the margin of the plate, just sinistrad of the base of this style is armed with three similar spines. Limb armament, pulvilli, tarsal claws and arolia as characteristic of the genus.

Head blackish carob brown, ocellar spots buffy. Antennae proximad buckthorn brown, becoming darker in remaining portions. Mouthparts, maxillary palpi and limbs ochraceous-buff tinged with tawny, the maxillary

[3] Ocellar spots not conspicuous, probably because this specimen is a dried alcoholic.

[4] Soft integument unfortunately conceals the dextral specialization.

palpi with distal joints darkened. Ventral surface of abdomen buckthorn brown. Pronotum much as in *notatus;* shining, with cephalic margin rather narrowly and lateral margins more broadly ochraceous-buff; remaining portions blackish carob brown except for a large, transverse area of ochraceous-buff meso-caudad, the outline of which is vague, but its form appreciably rounded trapezoidal.[5] Tegmina as in *lamprus*, translucent suffused with prout's brown, this regularly distributed but deepest at the humeral trunk, except the costal margin which is broadly buffy, the transition to the darker portions of the tegmina gradual. Wings transparent, very weakly tinged with prout's brown, this heaviest in area of costal veins to near their apices. Dorsal surface of abdomen buckthorn brown, darkened laterad but margined with ochraceous-buff. Cerci ochraceous-buff weakly suffused with prout's brown in proximal portions dorsad, prout's brown ventrad.

Length of body, 9.3; length of pronotum, 2.9; width of pronotum, 3.7; length of tegmen, 11; length of caudal tibia, 4.6; length of caudal metatarsus, 2 mm.

Large series of two species of the genus before us show that there is little variation in the distinctive male genitalia developed in each. In other respects close general similarity is shown by the known species of *Chromatonotus*.

The type is unique.

## Blattinae

**Periplaneta australasiae** (Fabricius)

Guatemala City, 2 adults.

**Periplaneta americana** (Linnaeus)

Guatemala City, 1 ♂.

## Panchlorinae

**Leucophaea maderae** (Fabricius)

Guatemala City, 1 ♂, 2 ♀.

**Pycnoscelus surinamensis** (Linnaeus)

Guatemala City, 4 ♀, 3 juv.

## Blaberinae

**Archimandrita tessellata** Rehn

Guatemala City, 4 ♂, 1 ♀, [Paris Museum and Hebard Cln.]. All of these specimens are heavily tessellate. All show a

[5] The broad base forming the cephalic margin is seen to be invaded on each side by a weak suffusion from the darker area cephalad.

pronotal marking not found in any of the Costa Rican or Panamanian material we have seen. The caudal margin of the pronotum between the shoulders is blackish brown, this gradually broadening at the shoulders and then as gradually disappearing. In the female this marking does not broaden at the shoulders. This feature gives to the material a distinctive appearance, but detailed comparison fails to show any other difference from the typical series. It is of interest to note that, between the region in which this material was taken and the previously known distribution of the species, far to the southward, all specimens of the genus we have seen from Nicaragua have represented a distinct species, *marmorata* of Stoll.

**Blaberus trapezoideus** Burmeister

Guatemala City, 3 ♂, 2 ♀, 1 juv. ♂, [Paris Museum and Hebard Cln.].

### Corydiinae

**Holocompsa nitidula** (Fabricius)

Guatemala City, 2 ♀, [Paris Museum and Hebard Cln.].
Aguna, Escuintla, 650 meters, 1 ♀, [Hebard Cln.].

**Holocompsa azteca** Saussure

Guatemala City, 1 ♀, [Paris Museum].

# ZOROTYPUS SWEZEYI, A NEW SPECIES OF THE ORDER ZORAPTERA FROM HAWAII

BY A. N. CAUDELL

*Bureau of Entomology, U. S. Department of Agriculture, Washington, D. C.*

The species of *Zorotypus* herein described is based on specimens received from Hawaii by Mr. Hebard, of Philadelphia, who kindly submitted them to the writer for determination. Considering the paucity of indigenous forms of Hawaiian insects, it seems doubtful if this is a native species. It was naturally surmised that this would prove to be an introduced species and probably a described form, more likely one of the East Indian species erected by Silvestri. It is still very probable that this may indeed be an introduction into Hawaii, but a careful comparison with descriptions and figures of the known forms of the genus shows it to differ from them all. It is thus herein described as new, and the specific name *swezeyi* proposed for it in honor of the collector of the specimens; this name is also suggestive of the supposed habitat, Mr. Swezey having been so intimately associated for many years with Hawaiian Entomology.

The subequal second and third segments of the antenna will at once differentiate this new species from the Old World forms and from the Nearctic species *snyderi*, while the more strongly armed ventral margin of the posterior femora will readily separate it from *hubbardi*. No specimens of *Z. neotropicus* are available for comparison, but these Hawaiian specimens do not appear to agree with the description of that species sufficiently well to warrant considering them as belonging there. The ventral armature of the posterior femora of *neotropicus* is apparently less robust than in the species here described and the antennae are also somewhat different. Direct comparison of specimens of both species would probably show various features of morphological dissimilarity.

*Description.*—(Unchitinized adult female): General color, shape and appearance very like that of *Z. hubbardi*.[1] The hirsute covering of the entire

[1] Proc. Ent. Soc. Wash., XXII, pl. VI, fig. 4, (1920).

body seems slightly more sparse than in *hubbardi*, the front in some specimens showing one or two irregular blackish subcutaneous spots, perhaps vestiges of degenerate eyes which are no longer present, though the spaces the eyes would occupy if developed are generally of a slightly different appearance, when carefully examined, from the rest of the surface of the head, due apparently to a slightly less degree of transparency at those points. Mouth parts not noticeably differing from those of *hubbardi* as described in the original diagnosis of that species. Antennae consisting of nine segments and essentially as those of *hubbardi*.

Pronotum about as in *hubbardi* but more narrowed posteriorly, due probably to shrinkage in drying. Meso- and metathorax usually decidedly shorter than the pronotum but shrinkage in drying varies proportionate measurements very decidedly, and fresh material or individuals preserved in spirits would very likely show these segments to be about as in the illustration of *hubbardi* mentioned above.

Abdomen apparently broader and more broadly rounded posteriorly than in *hubbardi* and, in all specimens examined, the tip has the terminal one or two segments turned inwards, but here again shrinkage may be the cause. The cerci are like those of *hubbardi* but are more or less concealed by the turning in of the apical segments of the abdomen as noted above; the terminal bristle is considerably longer than the cercus itself. Along the sides of the thorax and abdomen are some thicker and more bristly hairs than are most of those with which the entire insect is more or less sparsely covered.

Legs in general similar to those of *hubbardi* but differing decidedly in the ventral armature of the posterior femora; tibiae bearing short hairs, generally shorter than the tibial depth, some of the ventral ones, especially on the posterior tibiae, somewhat thickened and spur-like, but very small; anterior and intermediate femora not noticeably armed beneath except with some slightly thickened hairs; posterior femora armed beneath with eight or nine moderately stout chitinized spines, the apical one situated very near the apex of the femora and the others at more or less subequal intervals, the basal one or two generally somewhat longer and stouter than the others, and sometimes separated from each other and from the others by spaces a little greater than that between the more apical spines; the basal of these spines is situated some distance from the base of the femora, usually a distance about equal to the length of that spine; there seems to be much variation in this ventral armature of the posterior femora, as in some specimens the spines are more uniform in length than in others, or more equally spaced.

*Measurements.*—The total length is clearly somewhat greater than in *hubbardi*, but the only specimens seen are dried and evidently much shrunken. Certain measurements of the type specimen are as follows: length, antennae, 1.75 mm.; pronotum, .4 mm.; posterior tibia, .9 mm.; posterior femora, .85 mm.; width, pronotum anteriorly, .6 mm., posteriorly, .3 mm.

The great inequality of the pronotal width as shown by the above measurements is very surely due mostly to shrinkage and would not be so striking

in fresh material, though the pronotum is very likely proportionately broader than in *hubbardi*.

*Holotype*, female, Kokee, Kauai, Hawaii, August 19, 1921, collected by Swezey in decayed log. Paratypes *a*, *b*, *c* and *d*, females, same data as type except the last, which was collected on August 21.

Holotype and paratype *a* in collection United States National Museum; paratypes *b*, *c*, and *d* in collections of Bernice Pauahi Bishop Museum and Academy of Natural Sciences of Philadelphia. Catalogue No. 25416, U. S. N. M.

Mr. Swezey writes that the region where this insect occurs is a forested plateau, at an elevation of 3500 feet. It was found quite common in decayed logs.

The following key, based on that given by Silvestri,[2] may be found useful in distinguishing the seven species of *Zorotypus* now known:

*Key to the Species of the Genus Zorotypus*

1. Second and third segments of the antennae noticeably unequal in length.2
   Second and third segments of the antenna of about the same length.....5

2. Second segment of the antenna longer than the third..**guineensis** Silvestri
   Second segment of the antenna shorter than the third.....3

3. Second segment of the antenna no more than one-half as long as the third.4
   Second segment of the antenna more than one-half as long as the third.
   **ceylonicus** Silvestri

4. Cerci with some lateral setae fully twice as long as the cercus; habitat, Java.....**javanicus** Silvestri
   Cerci with lateral setae noticeably less than twice as long as the cercus; habitat, North America.....**snyderi** Caudell
5. Posterior femora armed beneath with but two stout chitinized spines; habitat, United States.....**hubbardi** Caudell
   Posterior femora armed beneath with six or more chitinized spines; habitat, Central America or Hawaii.....6
6. Spines on ventral margin of posterior femora rather robust; habitat, Hawaii (introduced?).....**swezeyi** Caudell
   Spines on ventral margin of posterior femora scarcely robust; habitat, Costa Rica.....**neotropicus** Silvestri

[2] Boll. Lab. Zool. Portici, VII, p. 205, (1913).

# NOTES ON THE LIFE HISTORY, PARASITES AND INQUILINE ASSOCIATES OF ANTHOPHORA ABRUPTA SAY, WITH SOME COMPARISONS WITH THE HABITS OF CERTAIN OTHER ANTHOPHORINAE (HYMENOPTERA)

BY THEODORE H. FRISON

*Urbana, Illinois*

Not many years have elapsed since Ashmead (1894), in his retiring address as President of the Cambridge Entomological Club, said in regard to the genus *Anthophora* that "Almost nothing is known of the nesting habits of our species." When this quotation was written our literature contained only a few short contributions to the life history of the American species of *Anthophora*. The first account is that given by Walsh (1868) and deals with certain phases of the biology of *Anthophora sponsa* Smith, as he observed them in Illinois. The *Anthophora sponsa* of Smith is now considered by the authorities on the subject as identical with *Anthophora abrupta* Say, the latter name having priority. Riley (1877) also published a few observations on the habits of *Anthophora sponsa* in connection with the description of a new genus and species of Meloidae found infesting the cells of this mining bee. In addition to these accounts, Say (1837) added to his specific description of *Anthophora taurea* a few observations on the habits of this species. This latter bee, however, is no longer regarded as belonging to the genus *Anthophora*. It was first removed by Patton (1874) when he erected the genus *Entechnia*, making *taurea* of Say the type. Since then this generic assignment has been adhered to by the authorities on the group. In the most recent list of the North American Anthophoridae, by Lutz and Cockerell (1920), *taurea* is still retained in the genus *Entechnia*, but the authors state "It seems quite probable that the name *Entechnia* must give way to *Melitoma*." As the two genera involved are closely related, in fact belong to the same subfamily, the original observations of Say are doubly interesting from a comparative standpoint. Since the time of Ashmead's address some additional

information has been obtained concerning the habits of a few species of the Anthophorinae and certain other insects that live in their cells and burrows. Reference is given to all such publications of interest from the standpoint of this article as they are mentioned in the text of this paper.

### A. Nest Situations

My attention was first called to a colony of *Anthophora abrupta* Say, when collecting insects near Oakwood, Illinois in the Spring of 1917. Oakwood is a small town about twenty miles east of Urbana, Illinois. Within a radius of two or three miles of Oakwood are many small areas, ecologically quite different, which offer ideal collecting grounds for this section of the state. One day while collecting Hymenoptera on flowers near the margin of a small rocky stream in this territory, I chanced upon several bees of this species eagerly lapping up moisture held by the fine sand bordering a tiny rivulet flowing into the main channel. As I watched I saw these bees hurriedly leave and others take their places, the whole performance being repeated again and again. As their going and coming seemed to be over a definite course I decided to follow them to their rendezvous if it were possible. In so doing I soon realized that the bees in their flight were following the line of least resistance, in this instance a passage-way, broken through the underbrush lining the river bank, and used by fishermen and other wanderers as myself. Scarcely two hundred feet from where I saw the bees zealously lapping up water I came upon a small clay bank which appeared literally alive with them. Figure 1 is a photograph of this bank, taken on July 11, 1919.

For various reasons I was unable to make further observations on the habits of this species in 1917 and 1918, but an opportunity was again presented in 1919 and 1920. One of the outstanding features of the habits of the adult *Anthophora abrupta* is its preference for the old colony site, at least such was the case with the members of this colony. This is evident when one considers that nearly all my observations relating to this species are centered about this one colony, first found in the late Spring of 1917, tenanted in 1919 and 1920, and with

every indication that the same state of affairs existed in 1918. The clay bank in which the bees made their homes was about three feet high, two to three feet wide and twelve feet long. It was situated but a short distance from the river beneath a steel bridge connecting with the opposite bank and beside one of the concrete foundations supporting the structure. Here the bank was in a semi-protected situation, but still at times exposed to the glare of the sun and rain blown about by the wind. To all appearances, the clay bank was simply a pile of clay removed by workmen when engaged in excavating for the concrete foundation pillars of the bridge. The clay was the same as that found anywhere along the river and any number of situations possessing about the same qualifications might have been selected by these mining bees.

Besides the colony just mentioned I found another one of the same species in the same year. This also was at Oakwood, Illinois, but on the opposite side of the river and about an eighth of a mile from the first colony. It is interesting to note that again I located the colony by following the flight of the bees returning to their homes after collecting water at the river bank for their mining operations. When I first came upon the bees going and coming from the moist sand near the river's edge, I knew by reason of previous experience the significance of this and immediately looked about for the site of the colony. This happened to be the precipitous clay wall of the river bank, not far from where the bees were obtaining their water supply. The colony was situated just below a large tree growing on the very brink of the almost perpendicular clay wall. Here, in the clay more compactly held together by the major root system of the tree, the bees had made their burrows. The colony was only about one-fifth the size of the one under the bridge and so hard of access that I made no further study of it.

When speaking of the situations selected by *Anthophora abrupta* for their mining operations it is interesting to note what other authors have to say concerning this species and certain other Anthophorinae. Walsh found this species making burrows in the mortar between joints in brick work and also in "the face of a precipitous clay bank." Riley says this same

species "builds mostly in steeply inclined or perpendicular clay banks." Evidently, judging from my observations and those of Walsh and Riley, *Anthophora abrupta* has a preference for a perpendicular or steeply inclined surface. Under natural conditions a compact clay bank is usually selected, for such a soil type seems better adapted to the peculiar mining activities of this bee and does not weather away so rapidly. A similar preference is exhibited by *Anthophora stanfordiana* Cockerell, a western species. Kellogg (1905) found a colony of this latter species near Stanford University, "in a roadside cutting exposing a clayey bank." Nininger (1920) reports finding two colonies of this same species occupying on one occasion, "the sunny slope of a moist clay bank in the foot hills of the San Gabriel Mountains of southern California", and another time, "a steep bank, facing south at the shore of the bay", on Angel Island.

Similar and different nest situations are chosen by allied bee genera. Say writes that *Entechnia taurea* "digs a cylindrical hole in a compact clay or adhesive earth on the side of a bank, or in earth retained amongst the roots of an overturned tree." Upon one occasion I found a colony of this same species located in a perpendicular clay bank beneath a railroad bridge crossing a stream at White Heath, Illinois. *Clisodon terminalis* Cresson, according to the late F. W. L. Sladen (1919), nests in wood and thereby differs biologically from the genera *Anthophora*, *Entechnia* and *Emphor*. Nichols (1913) has given us an account of the situation selected by *Emphor fuscojubatus* Cockerell. This species made numerous nest openings, "by the side of a road, for a distance of about one-eighth of a mile, in soil consisting of a mixture of clay, sand and pebbles." Grossbeck (1911) says that *Emphor bombiformis* [ = *fuscojubatus*] "seems to prefer hard, shaly soil in which to nest though small colonies occur in sandier soil."

### B. Size of Colonies and Gregarious Habits

A glance at figure 1 will show the portion of the bank occupied by the bee burrows and figure 2 shows how close the burrows are to one another. In order to get some idea as to how many bees belonged to this colony and to examine the contents of the cells, I dug from a fairly representative section of the bank

a piece containing about eight cubic inches of the hard, dry clay. This was on May 31, 1919. In a portion of this clay lump, containing two and one-half cubic inches of soil, I found eleven cells containing pupae of this bee. If the entire bank supported such a proportion it would have a total of one hundred and four thousand, two hundred and seventy-four cells. Such was not the case, however, for the burrows were most abundant on the upper part and on the most precipitous side. In 1921 the bees were harder pushed for desirable locations, for many made their burrows all over one end and some even took possession of the flat top surface. In many places the burrows and cells went back into the clay bank ten or twelve inches. A conservative estimate would indicate that in summer this *Anthophora* bank harbored about five thousand cells. A marked gregariousness is therefore exhibited by these so-called solitary bees. The same tendency towards a social type of existence characterizes the habits of *Anthophora stanfordiana*. Kellogg mentions a "great colony" of these bees and Nininger says that one colony of this same species occupied an area "extending over several square rods" and that it contained several thousand bees, while a second community was but "a small aggregation." Judging by Say's account of the habits of *Entechnia taurea*, as he observed them in Indiana, and by what I have noted in Illinois, these bees also like to nest close together. The colony of this latter species that I found at White Heath, Illinois, was composed of not over three hundred cells. Nichols says that *Emphor fuscojubatus* made numerous nest openings in the soil by the side of the road for a distance of about "one eighth of a mile." There is nothing in her account to indicate that these bees ever formed such concentrated colonies. Grossbeck, however, found several colonies of this same species of bee scattered short distances from one another, the largest having in the neighborhood of seventy bees, and the smallest eight to twelve bees each. The fact that *Clisodon terminalis* burrows in wood much in the manner of *Xylocopa* suggests that very large colonies are a rarity if they ever occur. It was once my fortune to rear adults of *Melissodes bimaculata* Lepeletier from cocoons found after they had been exposed by plowing. Apparently this species of Eucerine bee has habits comparable

with those of many of our common solitary bees. Ashmead has seen the same species of bee entering its burrow beneath a stone in an open field.

### C. Hibernation

Like many other Hymenoptera this bee hibernates as a larva within its cell. I have never examined an *Anthophora* bank during the winter months, but have other evidence in support of this statement. A visit to Oakwood on September 20, 1919, revealed the fact that the cells then contained full grown larvae. At this time I again brought back to the laboratory a lump of clay containing *Anthophora* cells. I divided this in halves, placing one portion in an old deserted bee-hive outdoors, thus subjecting the cell inmates to almost natural winter conditions. The other portion I kept in the laboratory under temperature conditions averaging about seventy degrees Fahrenheit. In March, 1920, I examined these two separate lots of *Anthophora* cells. On this date the inmates of the cells kept outdoors under approximately natural winter conditions were still in the larval stage. Those kept in the laboratory were still in the larval stage in February, but the influence of warmer conditions caused the larvae to begin to pupate in March. Thus we see that this bee normally hibernates in the larval stage protected by its earthen cell.

### D. Cell Formation

The adult bees use some liquid substance when first fashioning the cell, and it is probable that the larvae when they attain their full growth also contribute something to give the cell its characteristic durability. When a clod of clay containing these cells is broken apart, under ordinary conditions of stress the cells never collapse but hold their shape and may be readily sorted out from the débris. This again is proof that the bees and perhaps the larvae use a cementing substance. When a cell is broken open its inner lining has a smooth glazed appearance. This is due to the substance used in forming the protective cell and causing it to retain its characteristic shape. A complete cell is usually slightly recurved at its anterior end, which is an indication that the cells radiate off from the main stem-burrow which leads to the entrance of the nest. The

interior measurements of the cells average sixteen millimeters long by nine millimeters wide. Cells freed from all soil not actually entering into the formation of the same average twenty-five millimeters long and have a diameter of ten millimeters at the anterior end and twelve millimeters at the posterior extremity. Several times I have opened the over-wintering cells, removed the larvae within and then filled the cells full of water. On such occasions it was evident that the substance which held the cells together and gave them a glazed appearance on the inside, also served to make the cells impervious to water. Such a protection against soil moisture would seem to be a necessity in the case of bees like these which do not spin a silken cocoon within their surrounding cell.

I am sure that the adult bee when making her brood cells waterproofs them with some secretion. If she did not do so the semi-fluid mass of pollen and nectar on which she lays her eggs would be partially absorbed by the cells. Nininger speaking of *Anthophora stanfordiana* says that this bee in making her cells used "a thin layer of waterproofing which seemed to be a salivary secretion." Whether the larvae of any or all instars further improve the cell resistance by secretions or exudates I do not know. The larvae do not spin cocoons as do those of *Melissodes bimaculata* and many other bees not far removed phylogenetically or morphologically. If the larvae of *Anthophora abrupta* do improve their cells by a salivary secretion, it is possible that the basic substance of the cementing fluid used by this species, may be of a chemical composition quite similar to that of the silk spun by the larvae of *Melissodes bimaculata*. Another bee, *Emphor fuscojubatus*, differs biologically from *Anthophora abrupta* because of its cocoon spinning propensities, thus pointing to its closer biological relationship with *Melissodes bimaculata*.

### E. Pupal Stage

The pupal stage of development is entered into under natural conditions about the middle of May, or at least such was the case in 1919 and 1920. This is evidenced by the fact that on May 8, 1920, when I visited the bee-bank at Oakwood the cells contained larvae. A similar visit and examination on May 31,

1919, showed that the cells contained pupae. The period of pupal formation undoubtedly varies somewhat from year to year in direct correlation with climatal conditions. Under laboratory conditions the larval stage may be shortened and pupae formed about the first of March. On March 13, 1920, I brought into the laboratory some cells containing larvae which since the time of collection had been kept out of doors under approximately natural conditions. One of these cells contained a pupa on March 29. Other larvae in cells placed on September 20, 1919, under warm laboratory conditions, began to pupate in the early part of March. Such a forced expediting of the transformations under the influence of prematurely warm conditions apparently has a weakening effect, for an adult male emerging on March 18 died soon after escaping from his cell. Cells brought into the laboratory in Spring produced, however, adults of normal vitality.

The pupal stage is of short duration. Freshly transformed pupae collected at Oakwood on May 31, 1919, began to produce bees on June 7 and continued to do so until June 14. As the pupal stage nears completion the pupa gradually becomes darker and darker until the adult emerges. The emerging adults dig their way from the pupal cells with the aid of their stout mandibles. The males appear in advance of the females, as shown by both laboratory and field observations. Of the bees reared indoors in 1919, two males emerged on June 7, four males on June 8 and twenty-six more of the same sex on June 9. On June 11, eleven females emerged and enough more males to bring the total for that sex up to one hundred and four individuals. Females continued to appear until June 14, a total of sixty-five altogether. Cases of proterandry similar to this one seem to be quite common among bees, as was pointed out by Robertson (1918). Not only do the males appear first but in the colony I studied they dominated numerically by a ratio of about two to one. Observations at Oakwood in 1919 and 1920 confirmed my laboratory observations. On July 3, 1919, I visited the *Anthophora* bank and found a veritable swarm of female bees hovering about the bank and entrances to the burrows. Apparently I was just a little too late to see the males holding forth before the bank. On June 26, 1920, at the same

spot I witnessed the reverse of this phenomenon, for I saw only one female bee among the large number of bees flying about the entrance burrows. By breaking open some of the cells I discovered that the females were just beginning to emerge from their cells, the males having preceded them. I never found out what finally happened to the males, but judge that after they had mated with the females they spent the remainder of their short existence loitering about on flowers as do many male bees.

### F. Mining Operations and Attendant Activities

The scene presented on July 3, 1919, was an animated picture of industry, for the females were busily engaged in their nest building operations. A few females, either more industrious than the rest or favored by a slightly earlier date of emergence, seemed to have completed their residences. The vast majority, however, were still in the midst of the construction of their subterranean homes or were looking for a favorable site in which to start their burrowing. Everything seemed to be in confusion, yet rapid progress was being made everywhere. I was not surprised to find that in several instances bees returning to the bank entered the wrong holes. When this happened and the rightful owner was at home, the invasion was hurriedly repelled as evidenced by a pronounced buzzing and the hasty exit of the invader. On one occasion I saw the proprietor of a burrow drag her unwelcome guest out by one leg. Several times the rightful occupant of the burrow and the invading bee were in such a close embrace that both fell out and down the precipitous side of the bank together. Strangely enough I never saw these bees while thus quarrelling attempt to sting one another. Such quarrelling among solitary bees living close together has been previously noted by Grossbeck in the case of *Emphor bombiformis* (=*fuscojubatus*). The same species, according to the observations of Nichols, "on the contrary, so far as we could tell lived together, mutually harmonious, yet independent." Individual differences no doubt exist between members of the same species, but I am inclined to believe that local conditions and varying circumstances were responsible for the differences noted by these two last mentioned authors.

## G. Entrance Tubes

As already mentioned some of the burrows were evidently completed on July 3, 1919. One strange feature about the entrance to the burrows are the cylindrical tubes extending down and outward from the entrance holes. Walsh undoubtedly refers to these tubes when he writes that *Anthophora abrupta* builds an entrance to its burrows "of tempered clay . . . about two inches long and three quarters of an inch in diameter." Say, referring to the habits of the European *Anthophora parietina* Latreille, says that this species digs a hole in a clay bank and that the "entrance consists of a cylinder extending downwards from the mouth of the hole more than an inch in length and consisting of small pellets of earth compacted together, very rough on the exterior and smooth within." Certain other insects are known to construct cylinders at the entrance to their underground burrows. The cylinders about the orifice of each tunnel at Oakwood varied from a quarter of an inch to four inches in length. The inside diameter of the cylinders was about one-half inch. The difference in length is probably due to the fact that some of the burrows were started sooner than others, though it is possible that under certain environmental conditions erratic individuals may make them very short or even neglect them altogether. It is to be noted that in figure 2 many of the holes lack an entrance cylinder, but it is probable in this case that many if not all of these are simply old uninhabited burrows. As in the case of *Anthophora parietina* the tubes are very smooth on the inside, rough on the outside and made of small pellets of clay removed from the inside of the burrow. One peculiarity of the tubes or cylinders is an open fissure on the uppermost portion, more noticeable in some examples than in others. Similar "bent-over chimneys of clay" were observed by Nininger, and also by Kellogg, over the entrances to the burrows of *Anthophora stanfordiana*. *Entechnia taurea* likewise makes such an entrance chimney over the burrows according to Say, who says "many of the tubes . . . . , have a fissure above, throughout the whole length." Riley reports finding these odd-looking chimneys extending from the entrance of the burrows of *Anthophora abrupta*, and has theorized concerning their purpose. This writer has suggested that these

tubes make it difficult for the clumsy parasitic Meloid beetles to climb about the cells, and Kellogg says they prevent the "flooding of the open burrows by water." Walsh says the tubes serve to keep out parasites. If the tubes served in any way as a protection to the real entrance to the burrows of *Anthophora abrupta*, why is there this break in their continuity, especially upon the upper portion? Water could certainly gain entrance here and the rift is large enough to enable several of the smaller hymenopterous parasites to enter the tube. Furthermore, as the chimneys are open at the outer end I fail to see in them any effective barrier to the inroads of parasites. *Emphor fuscojubatus*, according to Grossbeck, builds little turrets one-half inch high around the entrance to the burrows and then drops the remainder of the pellets over the rim.

Watching the bees at their labors, I soon saw that the tube was formed by pellets of clay brought out from the burrows by the bees when engaged in their mining operations. After being in the burrows a short time the bees back out and carry with them, under the body, a small amount of wet clay. This explains why the bees were lapping up moisture when I first came across and followed them to their burrows in 1917. The bees go to a place where water is to be had and when they have lapped up all they can hold return to their burrows. Then they use the water to soften the hard clay in which they dig their burrows. If such is not the case how are we to explain the fact that the bees remove wet clay from burrows made in a hard dry clay bank? An interesting manner of obtaining water to use in their mining operations has been observed in the case of *Emphor fuscojubatus*. Grossbeck reports seeing adults of this species on the surface of roadside puddles, but was not sure they actually lapped up any of the water. Knab (1911) has observed *Emphor bombiformis* alighting on the surface of water and actually saw them lapping up the water. Nichols records the same curious habit for *Emphor fuscojubatus*, saying, "numerous bees were discovered floating on the surface [of a small pond] with legs outstretched, presumably sucking up into their crops a supply of water for use in making the nest."

Instead of simply dropping the clay from the entrance of the burrows these bees instinctively make with it a cylindrical tube

attached to the entrance of the burrow. When a bee reaches the end of the burrow or tube and has in its custody a wet pellet of clay it presses the pellet against the outer edge of the tube with the ventral surface of the abdomen and the posterior legs. The head and mandibles also take part in the final shaping of the pellet on the end of the tube. As this operation is performed in summer, the clay quickly dries and becomes an integral part of the tube. The exterior surface of the tube is never polished and hence remains rough. The interior surface, however, is smooth as a result of the polishing given it by the abdomen as the pellets are fastened on at the end. A similar instance of the abdomen "being used as a trowel" is recorded by Nichols for *Emphor fuscojubatus*. Grossbeck also has observed similar actions on the part of the same species. The fissure on the top of the tube appears to be due to the fact that *Anthophora abrupta* has an aversion to standing upside down while joining the pellets onto the tube. Not one of the bees I observed at this work ever assumed an absolutely upside down position, though all would work around on the edge nearly to the top. The definite course of each burrow was very difficult to trace. It seems that each female makes her own burrow and then digs lateral branches from the main stem which form the cells. I never managed to decide how many brood cells each female made and provisioned, but judge they are not numerous.

### H. Anthophilous Habits

On July 3, 1919, some of the bees returning to the nest were loaded with pollen. Bees so engaged in pollen storing seemed to have less difficulty in finding their burrows than those still in the midst of their mining operations. This is probably to be explained on the basis of a longer acquaintance with, and occupation of, their burrows, coupled with associative memory. On July 11, 1919, all the bees flying to and from the bank appeared to be females and were busily engaged in storing their cells with pollen and nectar. Robertson (1891, 1894, and 1896), in Illinois, records males and females as visitors to *Asclepias purpurescens*, *Hydrophyllum virginicum*, *Mertensia virginica*, *Convolvulus sepium*, *Pentstemon pubescens*, *Pentstemon laevigatus*, *Rosa humilis*, *Rosa setigera* and *Gillenia stipulacea*. Banks

(1911) reports this species from *Ceanothus*. No doubt this list of plants visited by the bees of this species could be considerably increased and thus we are dealing with a polytropic bee.

## I. Nidification and Feeding Habits of the Larvae

The females of *Anthophora abrupta* in 1919 laid their first eggs some time between July 3 and July 11. On July 11, 1919, I found the eggs to be deposited on a very soft, almost watery paste of pollen. Judging by the anthophilous habits of the adults and certain habits of other bees I feel sure the fluid used to moisten the pollen was regurgitated nectar. In general the egg-laying habits are similar to those observed for *Anthophora stanfordiana* and *Emphor fuscojubatus* by Nininger, Grossbeck and Nichols. When the cells are broken open any of the watery paste of pollen that spills out and comes into contact with the soil surrounding the cell is quickly absorbed. This is further evidence that the cell of this bee is rendered impervious to soil water by some kind of treatment by the adult. Otherwise the earthen cell would absorb at least a portion of the regurgitated nectar, and the pollen mixed with it and stored in the cell as larval food would dry out. The eggs are pearly white and have the same general appearance as those of bumblebees (Frison, 1917). One egg that I measured was two and one-half millimeters long and somewhat less than one millimeter wide. A single egg is laid in each completed and stored cell, which is then tightly closed by the mother bee. It is worth noting that the pollen-nectar food mass has a very pungent and offensive odor. I have no data on the duration of the egg stage but presume it is a matter of three or four days. The emerging larvae attain their full development on the provisions placed in their cell by the female bee before the egg is laid and the cell closed. Kellogg states that in the case of *Anthophora stanfordiana* "the food is carried to the young in the open cell." Nininger, who studied the same species, says that this is not true and that the cells are tightly sealed after the eggs are laid. Therefore, *Anthophora abrupta* and *stanfordiana* hae very similar habits and probably no larvae of *Anthophora* are fed daily by the adult bees. According to both Grossbeck and Nichols the eggs of *Emphor fuscojubatus* are deposited upon a mass of pollen from *Hibiscus moschatus*, and the emerging larvae ac-

cordingly develop without being fed by the parent bees. My last visit to Oakwood in 1919 was on September 20, and the cells then contained full grown larvae. No adults were observed at this time and as nidification was completed the bees had probably perished. The larvae at this time averaged about thirteen millimeters in length and five millimeters in their greatest diameter, and were of a lemon yellow color. It may be well to note at this place that, on September 20, almost all of the peculiar entrance tubes previously described had broken off and fallen to the foot of the bank.

### J. Miscellaneous Adult Habits

No opportunity was presented for a close study of the habits of the adult bees. Besides those traits already noted in connection with phases of their home building a few others merit recording. The bees never emerged from their pupal cells until they were ready to take flight. In the laboratory when the bees emerged in screened cages they flew towards the nearest source of light and made desperate attempts to escape from their prison. In so doing they demonstrated the great muscular power correlated with their large mandibles by drawing together a great many of the individual parallel wires forming the mesh of the screened sides of their cage. With such strongly developed biting powers it is no wonder that these bees are so adept at mining in hard clay banks. During the night and early morning the bees were not active and rested on the sides and the top of the cage. When resting, the bees hung onto the wire by their mandibles assisted by one or more pairs of legs. This position was also assumed when the bees cleaned parts of their body and legs. The disposition of the female *Anthophora abrupta* is very inoffensive. One can stand within a foot of the entrance holes to the burrows in the bank without danger of being stung. Even when I removed the cells from the bank swarming with females no resistance was encountered in spite of the fact that the females are armed with a good-sized sting. Such would not be the case with many social Hymenoptera, as anyone who has removed a bumblebee or wasp nest can testify. While I was seated on the ground near the bank watching their

movements, the bees would frequently alight on my hands and lap up drops of perspiration. They would even settle on and explore my camera outfit as if in search of a possible supply of moisture. No doubt the female will sting when picked up and roughly treated, but having had experience along this line with other bees I did not wish to try the experiment. In captivity these bees fed readily on a solution of honey and water.

### K. Observations on Parasite and Inquiline Associates

Continued occupation of the same bank year after year by large numbers of the same species of bee would seem to offer favorable opportunities for inquilinous and parasitic species of insects to become abundant. Riley has described a coleopterous insect by the name of *Hornia minutipennis* as occurring in the cells of this species. Another Meloë found in the cells of *Anthophora occidentalis* Cresson, has been described as *Hornia gigantea* by Wellman (1911), and according to Cockerell (1905) Mr. S. A. Johnson has found *Leonidia neomexicana* Cockerell in the cells of *Anthophora bomboides*. Though I have examined hundreds of cells of *Anthophora abrupta* I have never chanced upon a specimen of *Hornia*, but have found several other parasitic and inquilinous insects in the cells and burrows of these bees.

On May 31, 1919, I observed many specimens of an anthomyiid flying about the entrance holes. I caught fifteen of these flies and Mr. J. R. Malloch kindly identified them for me as *Pegomyia affinis* Stein. They were also found flying about the bank in the same manner on June 20, 1920, when the males were first beginning to emerge. Indoors in 1919, *Pegomyia affinis* began emerging on June 8 and continued appearing until June 14. As in the case of *Anthophora abrupta*, the males of this fly appeared first, my initial record for the appearance of the female flies being June 11. Hibernation is accomplished in a puparium in the old cells and burrows of the bees. I have never found any evidence that would indicate that larvae of *Pegomyia affinis* were ever parasitic. It seems that, after mating, the adult flies lay their eggs in and about the bee burrows when the bees are storing their cells. The emerging larvae then feed upon any waste products available and are therefore scatophagous. It may be that the eggs are sometimes laid in

the stored cells before they are closed, and the rapidly developing fly larvae cause the female bees to abandon them before they have finished with their provisioning. I have never found the puparia in a properly sealed cell, but several times have found partially opened cells which contained a large number of them. Usually ten or twelve puparia occurred near one another in the infested burrows. As adults of *Pegomyia affinis* were observed flying about the holes in the bank on September 20, it is probable this fly has more than one generation a year.

A true parasite of *Anthophora abrupta* is found in the bombyliid fly *Spogostylum albofasciatum* Macquart (det. J. R. Malloch). I first found the larva of this parasitic fly on May 31, 1919, in a bee cell. This larva transformed to a pupa on July 5 and emerged as an adult on July 26. On December 30, 1919, and April 9, 1920, I found two other larvae of this species in cells of *Anthophora abrupta*. Various other investigators have found *Spogostylum albofasciatum* to be a parasitic species. There is also a probability that the larva of this bombyliid, after having destroyed the bee egg or killed the larva, will feed on the pollen stored in the cell. I am certain, however, that no bees develop from cells that produce these flies, and therefore *Anthophora* must fall a victim to the fly larvae in either the egg or larval stages, sometime before the advent of fall and winter conditions. Malloch (1917) describes and figures the pupa of this species and gives a good general account of the inquilinous, predaceous and parasitic habits of this family.

Probably the worst fly parasite of this bee is a conopid. Unfortunately I have never been able to rear the adult. The puparium is quite similar to that of *Physocephala sagittaria* Say, a parasite of the bumblebees. I first found this parasite in dead and nearly dead bees which had fallen to the ground at the base of the bee bank at Oakwood on July 3, 1919. Dissection of these bees revealed the presence of the characteristic conopid larvae and in one specimen a recently formed puparium. In 1919 I tried to rear the adults of this fly but failed, due in some cases perhaps to poor conditions of humidity, but in five instances to the effectiveness of a secondary Hymenopterous parasite. Mr. A. B. Gahan very kindly named this secondary parasite for me as *Mestocharis williamsoni* Girault. It is interesting to note that this is the same species of *Mestocharis* that

emerges from the puparia of *Physocephala sagittaria* Say, a conopid attacking bumblebees, and strengthens my supposition as to the identity of the conopid enemy of *Anthophora abrupta*. The secondary parasites were first noticed emerging from a small hole in the cephalic end of the conopid puparia on July 15. An examination of eleven puparia on August 12 showed that five were victimized by this small parasite. Five of the remaining puparia were completely dried out on this date and one contained a dead adult which was not sufficiently developed to permit of identification as to genus or species. When I visited the bee bank at Oakwood on July 11, 1919, I picked up forty-nine additional *Anthophora* adults killed or nearly dead by reason of conopid parasitism. Some of the bees so killed were laden with pollen. In some cases the bees found on the ground were still able to walk around a little, and now and then would move about by violent jerks. All such queer acting bees were found to contain conopid larvae. In such cases I found the body of the fly larva in the abdomen of the bee, with the long neck-like process bearing the mouth parts inserted through the point of articulation of the abdomen and the thorax. Evidently the bee lives for some time after the conopid larva starts to develop within the bee abdomen, but dies when the larva becomes almost or full grown, and severs some of the vital organs and nerve connections centered in the thorax and about the articulation of the thorax and abdomen. This probably explains the contortions and nervous movements of the dying parasitized bees. The conopid larva forms a puparium within the abdomen of its victim soon after the bee dies and probably in this stage hibernates during the cold season, anywhere the bee happens to fall to the ground. As the duration of the life of the host bee is comparatively short, the conopid must have but one generation a year.

As already mentioned I reared adults of *Mesocharis williamsoni* from the conopid puparia, which are thus secondary parasites and beneficial to the *Anthophora*. I first noted the adults issuing from a conopid puparium on July 15, 1919, and other emergences continued for a week or more. On August 12, 1919, I isolated five puparia which seemed to be parasitized by this

little chalcid, the adults of which had not all emerged and were dead as a result of unfavorable rearing conditions. On October 27 I dissected these puparia. In order to escape, the chalcids first emerging make a tiny hole in one end of the puparium. This hole either by chance or instinct was made in all cases through one side at the anterior or head end of the hardened case. In one puparium without an emergence hole I counted out one hundred and fifty-two dead adult chalcids. In three others from which most of the adults had emerged, judging by the small emergence holes described above, I found from thirteen to twenty-two dead chalcids. In another somewhat broken puparium I found seventy-four adults. On the basis of these figures one conopid may produce a surprisingly large number of its enemies, which may possibly be produced through polyembryony. Another check on the ravages of the conopids appeared to be a bacterial disease. Of the forty-nine puparia picked up at the base of the bee bank on July 11, 1919, a majority of them at the time showed indications of such a disease.

*Monodontomerus* species (det. A. B. Gahan) is very likely a true parasite of *Anthophora abrupta*. The pupae of this large greenish chalcid were first found in the bee cells on May 31, 1919. As fifteen or more of these pupae, without surrounding cocoons, were found in a single cell containing no trace of any stages of the bee, I assume them to be parasites. The adults first began to emerge in the laboratory on June 11 and were very numerous in the cage on June 14. A careful examination of the surface of the bee bank at Oakwood on July 3, 1919, disclosed the fact that these parasitic hymenopterans were then abundant around the burrows and tubular entrance cylinders. I have no additional information relative to the habits of this species. It would seem that mating takes place in July and that the eggs are laid in or near the new bee cells. Another species of Hymenoptera was reared about June 1, 1919, from several brownish, rather loosely-spun silken cocoons found on May 31, 1921. Unfortunately the reared adults were lost and I do not know the species involved. These cocoons did not seem to be directly associated with closed cells and I can not state what the habits of this species are. In a cell opened on July 11, 1919, I found a fully developed bee pupa which I doubt was *Anthophora abrupta*. I tried to rear the adult but failed

and can only surmise it was that of some inquilinous or parasitic species of bee.

Mention should also be made of a fungous disease of the bee larvae. Some of the bee cells opened on May 31, 1919, contained shrivelled larvae covered with a whitish fungous growth. No doubt bacterial diseases also take their toll of the *Anthophora* bee population.

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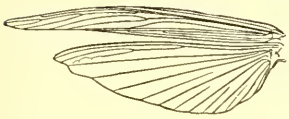
## Explanation of Plate V

Fig. 1.—Colony of *Anthophora abrupta* Say, at Oakwood, Illinois.

Fig. 2.—Close-up view of a portion of same bank occupied by *Anthophora abrupta*.



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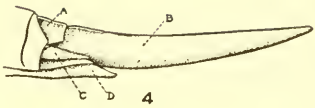


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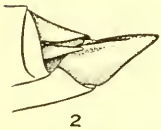

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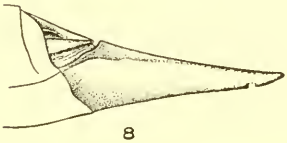

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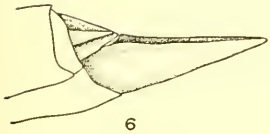

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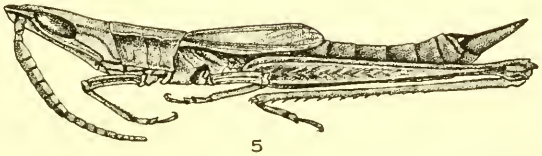

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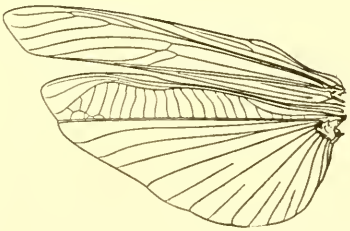

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Figure 1.

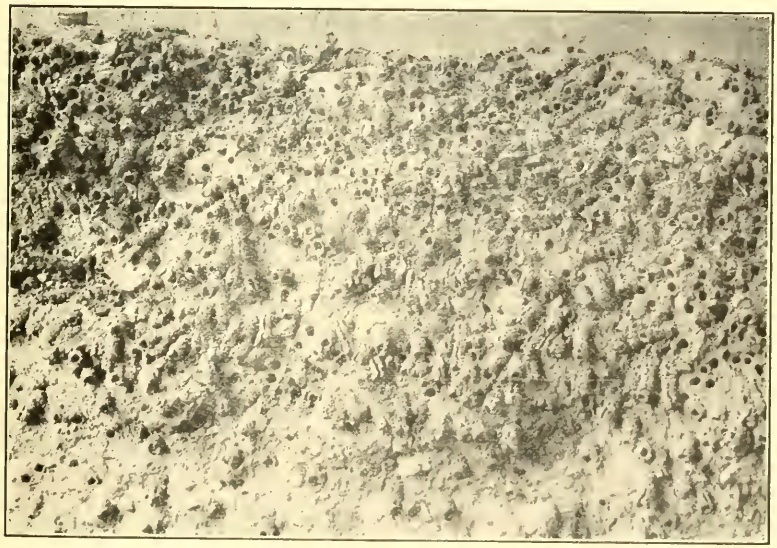

Figure 2.

FRISON—ANTHOPHORA ABRUPTA SAY

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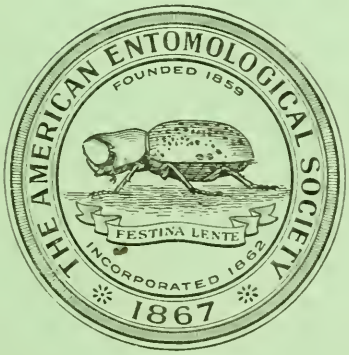


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# DERMAPTERA AND ORTHOPTERA FROM THE STATE OF SINALOA, MEXICO

BY MORGAN HEBARD

## Part I

### Dermaptera and Non-saltatorial Orthoptera

The collections here recorded were made in the State of Sinaloa, by Mr. J. A. Kusche, on two different trips, which were undertaken with the general collecting of insects in view. In 1916, his efforts were confined to Mazatlan, where little could be done, due to the disorders which were occurring everywhere outside that city. In 1918, however, several localities were visited, and during a stay at Venvidio, from June 16 to September 2, probably one of the largest and most representative series ever taken at a single locality in Mexico was secured.

In the present paper six hundred and sixty specimens are recorded, representing twenty-nine genera and thirty-seven species, of which one genus and eleven species were undescribed.

The distribution of these species, or of their nearest affinities, is noted in the following table.

| | |
|---|---|
| **Dermaptera** | |
| *Euborellia annulipes* (Lucas) | Cosmopolitan. |
| *Vostox brunneipennis* (Serville) | Northward and southward. |
| **Prosparatta sinaloae* new species | Related species southward. |
| *Doru lineare* (Eschscholtz) | Extreme southwestern U. S. to South America. |
| **Orthoptera** | |
| **blattidae** | |
| **Euthlastoblatta grata* new species | Extreme southern Texas to Panama. |
| *Latiblattella lucifrons* Hebard | Extreme southwestern U. S. to Sinaloa. |
| *Latiblattella picturata* Hebard | Southern Baja California, Sonora and Sinaloa. |
| **Ischnoptera bicornuta* new species | Related species southward. |
| **Cahita nahua* (Saussure) | Southward, but only in Mexico. |
| *Pseudomops septentrionalis* Hebard | Southern Texas and northern Mexico. |
| **Nyctibora tetrasticta* new species | Related species southward. |
| *Periplaneta americana* (Linnaeus) | Cosmopolitan. |

| | |
|---|---|
| *Periplaneta australasiae* (Fabricius) | Cosmopolitan. |
| *Pycnoscelus surinamensis* (Linnaeus) | Circumtropical and subtropical. |
| *Panchlora cubensis* Saussure | Extreme southern Texas to South America. |
| **Panchlora cahita* new species | Related species southward. |
| *Panchlora montezuma* Saussure and Zehntner | Related species southward. |
| *Nauphoeta cinerea* (Olivier) | Circumtropical. |
| **Holocompsa scotaea* new species | Related species tropical North American. |
| *Compsodes schwarzi* (Caudell) | Extreme southwestern U. S. to Sinaloa. |
| **Caloblatta lampra* new species | Related species southward. |
| **Chorisoneura anisoura* new species | Related species southward. |
| **Chorisoneura flavipennis* Saussure and Zehntner. | Sinaloa southward. |

MANTIDAE

| | |
|---|---|
| **Mantoida maya* Saussure and Zehntner | Tropical North America and northern South America. |
| **Yersinia mexicana* (Saussure) | Southward, but only in Mexico. |
| **Oligonicella mexicana* (Saussure and Zehntner) | Sinaloa, southward to Guatemala. |
| **Oligonicella tesscllata* (Saussure and Zehntner) | Southward, but only in Mexico. |
| **Mellicra atopogamia* Saussure | Sinaloa, southward to Guatemala. |
| *Stagmomantis tolteca* (Saussure) | Mexico, southward. |
| *Stagmomantis limbata* (Hahn) | Southwestern U. S. to Sinaloa. |
| *Stagmomantis colorata* new species | Related species northward. |
| **Acanthops bidens* new species | Related species southward. |
| *Phyllovates chlorophaea* (Blanchard) | Extreme southwestern U. S. to Panama. |
| **Vates pectinata* Saussure | Tropical Mexico. |

PHASMIDAE

| | |
|---|---|
| **Diapheromera erythropleura* new species | Related species southward, but only in Mexico. |
| **Bostra actolus* (Westwood) | Southward, but only in Mexico. |

It would appear that Sinaloa is the northernmost area reached on the west coast of Mexico by many of the tropical forms. Collections from Sonora, the Gulf of California and Baja California recently examined, did not include any of the nineteen such forms indicated by an asterisk in the above list.

Excluding the forms carried by commerce and those having a distribution extending both northward and southward, we find that, in the present list, only five species previously known only from north of Sinaloa or related to species there found.

Of the thirty-one species recorded, other than those carried by commerce, eleven are at present known only from this region, while three or more are known elsewhere only from extreme southern Baja California and southern Sonora.

The material here recorded, unless otherwise stated, is in the author's collection.

## DERMAPTERA

### Labiduridae

**Euborellia annulipes** (Lucas)

1847. *Forficelisa annulipes* Lucas, Bull. Soc. Ent. France, (2), v, p. lxxxiv. [Jardin des Plantes, Paris, (probably introduced from North America).]

Las Mochis, II, 2, 1918, 1 ♂, 2 ♀. Mazatlan, XII, 16 to 31, 1916, 9 ♂, 10 ♀, 8 juv.

### Labiidae

**Vostox brunneipennis** (Serville)

1839. *Psalidophora brunneipennis* Serville, Hist. Nat. Ins., Orth., p. 30. [Philadelphia, Pa.]

Venvidio, VI, 30 to VIII, 3, 1918, 1 ♀.[1]

This specimen differs from the series before us, from the United States, in having the tegminal shoulders very slightly and inconspicuously paler than the other portions[2], and the internal faces of the forceps strongly hirsute.

**Prosparatta sinaloae** new species (Plate VI, figures 1, 2 and 3.)

This insect represents a simplified type, showing least specialization of the species of the genus. In its slender form it agrees with the genotype, *P. incerta* (Borelli), the other species *P. humilis* Hebard and *P. flavipennula* (Rehn) being distinctly more robust.

[1] In addition we have examined the following material:

Cordoba, Vera Cruz, II, 24, 1908, (F. Knab), 2 ♂, [U. S. N. M.]. These specimens differ, from the other material at hand, in having the forceps with the usual median tooth situated at end of proximal third of the internal margin heavier, and in being furnished with a much smaller but distinct dorsal tooth at base of distal third. The specimens are richly colored.

[2] See discussion of this feature for the species, Trans. Amer. Ent. Soc., XLIII, p. 307, (1917).

The eyes are comparatively large, equalling the cheeks in length. In the male the short pygidium with minute lateral projections and truncate apex, and the forceps unarmed except of a minute proximo-internal tooth, are distinctive. In general form of pygidium nearest agreement with *humilis* is shown, that species, however, having the pygidium without lateral projections and with apex much narrower. The same is true of the female forceps also, in which, however, the flange of the internal margin, conspicuous in *incerta* and *flavipennula*, has become subobsolete.

*Type.*—♂; Venvidio, Sinaloa, Mexico. June 30 to July 3, 1918. (J. A. Kusche.) [Hebard Collection, Type no. 754.]

Size medium small of the genus; form moderately depressed, slender. Head with occiput flattened but not impressed, cheeks as long as eyes. Antennae with first segment large, broadening just before median point; second minute; third slightly shorter than first;[3] fourth decidedly shorter; succeeding segments increasing strongly and regularly in length distad. Pronotum[4] distinctly longer than broad, smooth, with a medio-longitudinal linear sulcus very feebly indicated; rectangulate cephalad, broadly convex truncate caudad; lateral margins straight, showing an almost imperceptible divergence caudad; prozona tumid, this becoming very weak caudad; metazona deplanate. Tegmina smooth, with distal margin truncate, weakly oblique; wings with exposed area nearly one-half as long as tegmen. Abdomen with glands very weakly developed; surface of abdomen polished, almost smooth, rugulose condition subobsolete. Ultimate tergite smooth, length slightly less than half its width, showing a weak triangular depression meso-distad, caudal margin transverse with a very feeble concavity about the pygidium. Pygidium small, about as wide as long, declivent with surface convex, lateral margins very weakly convergent, terminating on each side in a minute point, beyond more strongly convergent and weakly convex to median third of this portion which is truncate. Forceps parallel to their apices which are incurved; showing a slight flattened production of dorso-internal margin at end of proximal two-fifths, the shaft, from that point distad, more decidedly flattened distad than proximad; internal surface granulate except distad, with a minute proximal tooth mesad above the median point of the pygidium on each side. Penultimate sternite ample, less than twice as broad as long, with latero-caudal angles broadly rounded and distal margin transverse, fringed with closely placed, short, microscopic hairs. Caudal metatarsus as long as last joint, hairy ventrad with a fringe of lamellae on ventro-internal margin.

[3] This is also true of the paratypes of *humilis* in the author's collection.

[4] This is taken from the allotype, as the pronotum is deformed in the type.

*Allotype.*—♀; same data as type. [Hebard Collection.]

Agrees closely with male, differing only as follows. Pygidium small, simple, triangular with apex rounded. Forceps more nearly approximated, shorter and very slightly heavier, armed at base with a projection twice as broad as long, the distal margin of which is straight. Shaft of forceps straight, much as in *incerta*, but without a distinct flange, the internal margin irregular, sublamellate proximad, this disappearing evenly into the margin of the distal curvature, as in *humilis*, but even more weakly indicated. Penultimate sternite with distal margin evenly convex, fringed with closely placed, short, microscopic hairs.

Entire insect glabrous. Head, pronotum and tegmina very dark chestnut brown, the head darkest. Mouthparts and antennae proximad buckthorn brown, remaining portions of antennae becoming darker, dresden brown. Exposed portions of wings antimony yellow, rather broadly suffused along sutural margin with dark chestnut brown. Abdomen dorsad bright tawny (*type*), or light ochraceous-tawny with an orange tinge (*allotype*), shading to blackish chestnut brown laterad. Forceps russet. Limbs immaculate, rich antimony yellow. Ventral surface the same, becoming russet on all but proximal portion of abdomen.

Length of body, ♂ 9, ♀ —[5]; length of pronotum, ♂ 1.2, ♀ 1.3; width of pronotum, ♂ 1, ♀ 1.1; length of tegmen, ♂ 2.3, ♀ 2.3; length of forceps, ♂ 2.8, ♀ 2.1 mm.

The species is known from the described pair.

### Forficulidae

**Doru lineare** (Eschscholtz)

1882. *Forficula linearis* Eschscholtz, Entomogr., p. 81. [♀; Santa Catharina, Brazil.]

Mazatlan, XII, 28, 1916, 2 ♂, 4 ♀. Villa Union, IX, 27, 1918, 11 ♂, 3 ♀. Rosario, 1 ♂, 6 ♀. Venvidio, VI, 30 to IX, 2, 1918, 12 ♂, 20 ♀.

The extremes in size of the present series are: length of body, ♂ 10.9 to 13.8, ♀ 8.4 to 12.4; length of forceps, ♂ 3.8 to 6.3, ♀ 3 to 3.3 mm. All have fully developed wings.

## ORTHOPTERA

### Blattidae

#### pseudomopinae

**Euthlastoblatta grata** new species (Plate VI, figure 4.)

This beautiful insect closely resembles *E. abortiva* (Caudell), differing in the very much smaller size and form of the male subgenital plate, which is more nearly symmetrical, with meso-

[5] Of the same general size as the male, this specimen measures 11.7 mm. in length, as the abdomen has been pressed out greatly.

distal angulate emargination less decided, and styles more slender and without as numerous or as stout hairs as are found in that species.

*Type.*—♂; Venvidio, Sinaloa, Mexico. July 28 to August 1, 1918. (J. A. Kusche.) [Hebard Collection, Type no. 756.]

Size very small for the genus, smaller than *E. orizabae* (Saussure); form moderately slender. Interocular space broad, very slightly narrower than that between the antennal sockets. Maxillary palpi with fourth joint very slightly shorter than third, fifth slightly shorter than fourth. Pronotum with surface weakly convex, showing a faint discal flattening caudad; outline symmetrically rounded-trapezoidal, greatest width meso-caudad. Tegmina and wings fully developed, extremely delicate in structure, numerous discoidal sectors of the former oblique.[6] Supra-anal plate[7] very strongly transverse, free margin showing a broad convexity with median emargination feebly suggested. Paired plate beneath supra-anal plate nearly symmetrical, lamellate laterad, suddenly enlarged mesad. Concealed genitalia complex.[8] Subgenital plate with surface moderately convex except before the styles, where it is weakly concave; lateral margins broadly concave and weakly oblique to styles, between these the distal margin is truncate in ventral aspect, but angulate at slightly more than a rectangle in caudal aspect. Styles situated on apices thus formed, very small rounded processes about twice as long as broad, unarmed but supplied with hairs. Limb armament as described for the genus,[9] except that the ventro-caudal margin of the cephalic femora has a median as well as a distal spine.

Pronotal marking as in *abortiva*,[10] with caudal margin and cephalic portion of disk blackish brown, intervening band and margin of discal marking buffy, lateral portions transparent, faintly tinged with brown. Tegmina very delicately tinged with sudan brown, paling laterad. Head brussels brown paling on face, there obscurely mottled with buffy. Palpi, underparts and limbs ochraceous-buff, the abdomen weakly suffused with brown distad.

Length of body, 6.8; length of pronotum, 2; width of pronotum, 2.6; length of tegmen, 7.3; width of tegmen, 2.5 mm.

The type of this striking but diminutive species is unique.

[6] See generic description for other characters of venation. Mem. Amer. Ent. Soc., no. 2, p. 26, (1917).

[7] The dorsal surface of the abdomen can not safely be examined in this unique specimen; it is probably unspecialized as in *abortiva*.

[8] A whorl of spiniform hairs, suggesting those found in *abortiva*, though differently arranged, is visible. The genitalia can not be examined thoroughly in this specimen.

[9] In *orizabae* a very similar condition is shown, but in the Compsa Group of *Euthlastoblatta* a decided difference occurs, the ventro-cephalic margin of the cephalic femora showing a strong tendency toward the condition termed type "A."

[10] Figured, Mem. Amer. Ent. Soc., no. 2, pl. 1, figs. 1 and 7, (1917).

**Latiblattella lucifrons** Hebard

1917. *Latiblattella lucifrons* Hebard, Mem. Amer. Ent. Soc., no. 2, p. 43, pl. 1, figs. 18 to 23. [♂, ♀; Santa Rita, Huachuca and Baboquivari Mountains, Arizona.]

Venvidio, VI, 24, to IX, 2, 1918, 31 ♂, 8 ♀, 2 juv.

We have recently recorded other Mexican material of the species,[11] from San José del Cabo, Baja California and Huejotitlan, Jalisco. We are still unable to locate *L. dilatata* (Saussure) and *L. chichimeca* (Saussure), the insufficient descriptions of these species, as we already have stated, leaving us in no doubt as to their generic positions, but in complete ignorance as far as the most important specific diagnostic characters are concerned. Examination of the types and material from central and central eastern Mexico can alone clear up the obscurity. It appears from the present material, however, that *lucifrons* is closely related. In our original discussion we assigned to *dilatata* a female from Baja California, which we now believe represents a depauperate specimen of the species recognized as *lucifrons*. We were in even more serious error at that time in comparing with males of that species, specimens of the same sex of *L. picturata*, a species which we have recently described from Baja California. Hence our original comparisons for *lucifrons* are worthless.

*Measurements (in millimeters)*

| ♂ | Length of body | Length of pronotum | Width of pronotum | Length of tegmen | Width of tegmen |
|---|---|---|---|---|---|
| Venvidio, Sinaloa (31) | 13–14.8 | 3.3–3.8 | 4.9–5.2 | 12.9–14.6 | 4–4.4 |
| Huejotitlan, Jalisco. | 13.7 | 3.7 | 5.1 | 15 | 4.5 |
| ♀ | | | | | |
| San José del Cabo, Baja California | 10.2 | 3.3 | 5.1 | 9 | 3.6 |
| Venvidio, Sinaloa (8) | 12.4–14.8 | 3.9–4.2 | 5.7–5.9 | 10.6–11.2 | 4.3–4.4 |

The smallest female shows close agreement with the type female of *L. dilatata* (Saussure) in measurements, the largest male similarly showing as close agreement with the measurements given for the male type of *L. chichimeca* (Saussure and Zehntner).

[11] Trans. Amer. Ent. Soc., XLVII, p. 203, (1921).

In the present series the majority have the head pale, many with a broad band of brown between the ocelli, this expanding in intensive examples and in the maximum intensification shown the head is dark brown, except for the pale buffy occiput. The pronotal disk is buffy, often with a few microscopic dots of pale brown, these dots darker and more numerous in the maximum intensive condition, but never conspicuous.

**Latiblattella picturata** Hebard

1921. *Latiblattella picturata* Hebard, Trans. Amer. Ent. Soc., XLVII, p. 203, pl. XIII, figs. 2 to 8. [♂, ♀: San Jorge, Sierra el Taste and San Josè del Cabo, Baja California, Mexico; Venvidio, Sinaloa, Mexico.]

Venvidio, VI, 16, 1918, 1 ♂, 1 juv. ♂.

This species, apparently nearest in relationship to *L. zapoteca* (Saussure), belongs to that section of the genus including species which are beautifully and strikingly marked.

**Neoblattella sinaloae** new species (Plate VI, figures 5 and 6.)

This species, known only from the male sex, is a small and inconspicuous type, which we place after *N. fratercula* Hebard. It does not appear, however, to show close affinity to any of the species known to us.

The tegmina are very slightly more coriaceous than in *fratercula*, with the numerous cross-veinlets so delicate and colorless that they can not be seen by the naked eye. The subgenital plate is distinctive, quadratic emarginate on each side, with heavy, armed, similar cerci and median portion produced in a large, symmetrical, unspecialized pentagonal patelliform projection.

*Type.*— ♂; Venvidio, Sinaloa, Mexico. July 20 to 22, 1918. (J. A. Kusche.) [Hebard Collection, Type no. 758.]

Size small for the genus, form moderately slender. Interocular space four-fifths as wide as that between the antennal sockets; ocellar spots moderately large and distinct. Maxillary palpi elongate, fifth joint three-quarters as long as fourth, obliquely truncate in distal two-thirds, fourth joint nearly as long as third. Pronotum weakly convex, greatest width meso-caudad. Tegmina and wings fully developed, extending well beyond cercal apices. Tegmina with (six) longitudinal discoidal sectors, cross-veinlets subobsolete, except in area of dextral tegmen concealed when at rest. Wings with (six) costal veins rather heavily clubbed distad, ulnar vein with two branches, intercalated triangle moderately well developed. Dorsal surface of abdomen unspecialized. Supra-anal plate strongly transverse, very broadly and

weakly triangularly produced and broadly and bluntly bilobate. Subgenital plate with lateral portions moderately ascendant, abruptly emarginate in such a way that a large square emargination is left on each side of the mesal produced portion, the angles of which are rounded, projecting angles of lateral portions thus formed very bluntly acute-angulate; meso-distal portion of plate produced an equal distance caudad, three-fifths as long as broad, its lateral margins straight and very weakly convergent, its distal margin very broadly rounded obtuse-angulate. Styles situated at bases of the square lateral emarginations, similar, heavy, cylindrical, twice as long as broad with apices bluntly rounded, extending as far caudad as median and lateral portions of the plate; ventral surfaces of styles subchitinous and weakly concave, dorsal surfaces well supplied with minute but stout spines from base to apex. Lateral portions of subgenital plate adjacent to these styles somewhat thickened and hairy on both internal and external surfaces. Sinistrad, from the soft integument within the anal chamber, projects distad an elongate, slightly curved, chitinous spike, with a smaller, similar spine, also directed distad, at its base. Limbs and their armament, pulvilli and arolia as normal for *Neoblattella*. Tarsal claws symmetrical: flange, usual in the genus, very weakly developed and marginal teeth very minute, microscopic, subobsolete.

General coloration translucent ochraceous-buff. Lateral margins of pronotum and all of tegmina weakly transparent, tinged with ochraceous-buff more strongly than in *fraterculo*. Disk of pronotum ochraceous-buff with a picturing of prout's brown, which is not complex, but is distinct. Wings hyaline with a slight iridescence, very faintly tinged with ochraceous-buff, veins and distal portion of anterior field more strongly so, clubs of costal veins opaque ochraceous-buff. Head ochraceous-buff, with a broad interocular band of dark prout's brown, four suffused spots of the same between the ocelli, four more in an arcuate line between the antennal sockets and one on each side ventro-mesad of the antennal sockets. Antennae ochraceous-buff with first and second joints marked with a suffusion of prout's brown. Palpi, underparts and limbs ochraceous-buff, the latter with flecks of prout's brown at bases of the heavier spines. Dorsal surface of abdomen mottled ochraceous-buff and warm buff. Cerci ochraceous-buff, all of the segments ventrad and three meso-distal segments dorsad, toward their internal margins, showing suffusions of prout's brown.

Length of body, 9.5; length of pronotum, 2.8; width of pronotum, 3.7; length of tegmen, 10.5; width of tegmen, 3.3 mm.

The type is unique.

**Ischnoptera bicornuta** new species (Plate VI, figures 7, 8 and 9.)

This species belongs to the group including *I. tolteca* Saussure. Compared with a pair from the National Museum belonging to that species, from Santa Lucrecia, Vera Cruz, *bicornis* is found to differ in both sexes in the pronotal color pattern, the

pale lateral margins not invading the more extensive dark area latero-caudad. In the male sex the supra-anal plate is subchitinous mesad instead of meso-distad, roundly and evenly triangularly produced, with hairs and stout spines along the free margin; the specialization at the bases of the cerci is distinctive, while the styles are smaller, more slender and less heavily armed. In the female the supra-anal plate is triangularly produced with apex bluntly rounded.

*Type.*—♂; Venvidio, Sinaloa, Mexico. September 2, 1918. (J. A. Kusche.) [Hebard Collection, Type no. 759.]

Size small, form moderately slender, much as in *tolteca*. Interocular space slightly over half that between the antennal sockets. Ocelli large and distinct but with flattened surfaces of ocellar areas forming a very blunt angle with the interocellar area. Maxillary palpi short, fifth and third joints of equal length, appreciably longer than fourth. Antennae, palpi, limbs and ventral surface decidedly hairy, particularly the fifth joint of the maxillary palpi. Latero-caudal sulci of pronotal disk distinct and broad. Tegmina and wings extending well beyond cercal apices. Wings with a moderately well developed intercalated triangle. Dorsal surface of abdomen specialized as is characteristic of the genus. Eighth tergite with caudal margin rather strongly concave. Supra-anal plate subchitinous in median section, triangularly produced between cerci with lateral margins broadly convex and apex rather sharply rounded, free margin well supplied with elongate hairs but entirely lacking minute spines. From inside the base of each cercus a large horn-like chitinous process is directed meso-caudad, the sinistral gently curved dorsad, the dextral heavier and longer, gently curved mesad and then very weakly ventrad.[12] Subgenital plate large, extending caudad beyond apex of supra-anal plate, convex with sides gradually reflexed, but broadly and shallowly concave before the styles. Styles situated slightly sinistrad of the median point, separated by a distance equal to the width of one of them, moderately stout, both armed in distal half of dorsal surface with a few minute, stout spines; sinistral style very weakly curved, tapering to its blunt apex, nearly four times as long as its proximal width; dextral style slightly longer, four times as long as its basal width, its distal portion very slightly thickened and bent weakly ventrad. Limbs, their armament, pulvilli, tarsal claws and arolia as characteristic of the genus.

*Allotype.*— ♀; same data as type. [Hebard Collection.]

Very similar to male, but showing the following differences. Interocular space three-quarters that between the antennal sockets. Dorsal surface of abdomen unspecialized. Organs of flight slightly more ample. Supra-anal plate triangularly produced between cerci, with lateral margins scarcely convex and apex rather sharply rounded, though not as sharply as in male. Paired

[12] These processes of the concealed genitalia appear to be normally visible from above, lying outside the supra-anal plate.

plate beneath supra-anal plate formed into two large, lamellate, chitinous and symmetrical valves. Subgenital plate evenly convex, with free margin evenly and broadly convex, except before the cerci, where a very weak concavity is indicated.

Pronotum shining, cephalic margin narrowly and lateral margins more broadly opaque, warm buff, remaining portions very dark chestnut brown, paling along caudal margin to hazel. The pale marginal band does not invade the dark area latero-caudad. Head blackish chestnut brown; ocelli and palpi warm buff, the latter with all but proximal portion of distal joint suffused with prout's brown; mouthparts and two proximal joints of antennae ochraceous-buff, remaining portions of the latter prout's brown. Tegmina weakly transparent, tawny, paling to buckthorn brown distad and along costal margin, marginal field transparent light buff, the mediastine vein distinct and brown to slightly beyond its median point. Wings transparent, very faintly tinged with cinnamon brown, veins cinnamon brown or paler, distal portions of costal veins buffy (this including the entire area of the costal veins in the specimen from Baja California). Remaining portions of dorsal surface buffy; mesonotum, metanotum and distal portion of abdomen washed with brown. Cerci mummy brown. Ventral surface and limbs ochraceous-buff, the abdomen tinged with tawny,[13] the coxae each with a suffused spot of prout's brown proximad, the spines tawny.

Length of body,[14] ♂ 11.8 to 11, ♀ 11.7 to 11; length of pronotum, ♂ 3 to 2.9, ♀ 3.25 to 3.1; width of pronotum, ♂ 4 to 3.8, ♀ 4.15 to 4.1; length of tegmen, ♂ 12.3 to 12.2, ♀ 12.7 to 12.6; width of tegmen, ♂ 3.8 to 3.8, ♀ 4 to 4 mm.

In addition to the described pair, a paratypic male from Villa Union, Sinaloa, taken by J. A. Kusche, September 2, 1918, and a female from San José del Cabo, Baja California, have been examined.

### CAHITA[15] new genus

This genus, known to us only from the male sex, in structure and coloration suggests the genus *Symploce*, the form, however, being even broader. Further examination, shows it to be a very distinct entity, remarkable for the distinctive palpi, ventro-cephalic margin of the cephalic femora armed as in *Ischnoptera* but with only two heavy distal spines, very weak production

[13] In some specimens deepening to russet distad.

[14] The measurements for the male type are given first, a male paratype from Villa Union second. For the female sex the allotype is given first, a female from San José del Cabo second.

[15] A vigorous Sonoran Branch of the Uto-Aztecan Indians, inhabiting the region in which this species occurs.

caudad of the pronotum, tegmina with unbranched discoidal vein and longitudinal discoidal sectors, wings with unbranched discoidal and straight ulnar vein, dorsal surface of the abdomen with median segment specialized mesad and ninth tergite with produced latero-caudal angles, nearly symmetrical male subgenital plate with simple, similar styles but armed distal margin, large pulvilli and arolia and very strongly asymmetrical tarsal claws.

In linear arrangement we place this genus after *Symploce* in the Group Ischnopterae.

*Genotype.*—*Cahita nahua* (Saussure).

*Generic description.*—Size medium for the group, form broad, texture moderately delicate, in this latter respect as in *Symploce*. Interocular space moderately broad, ocellar areas weakly defined. Maxillary palpi short and heavy, fifth joint specialized. Pronotum broad, evenly and weakly convex, caudal margin broadly rounded obtuse-angulate produced, point of greatest width meso-caudad. Tegmina and wings fully developed in both sexes. Tegmina moderately broad, discoidal vein unbranched, discoidal sectors (nine to ten) longitudinal. Wings with mediastine vein extending to beyond median point, discoidal vein unbranched, costal veins slightly thickened distad, not clubbed, ulnar vein straight with (four) incomplete and (five) complete branches, intercalated triangle very small. Abdomen of male with median segment specialized and ninth tergite with latero-caudal angles decidedly produced. Supra-anal plate triangularly produced in both sexes. Subgenital plate of male symmetrical, with simple similar styles, distal margin armed. Limbs rather stout for the Group. Cephalic femora with ventro-cephalic margin armed with (four or five) heavy proximal spines, succeeded by a scattered, irregularly placed row of minute, chaetiform spines, terminated by two elongate, heavy spines, of which the more distal is the longer (these latter sometimes absent). Other ventral femoral margins supplied with elongate, heavy spines. Tarsi comparatively stout and covered with minute but coarse hairs, first four joints supplied with large pulvilli distad. Very large arolia present between the stout, unspecialized, strongly asymmetrical tarsal claws.

**Cahita nahua** (Saussure) (Plate VI, figures 10, 11 and 12.)

1868. *Ischnoptera nahua* Saussure, Rev. et Mag. de Zool., (2), XX, p. 356. [♂, ♀; [Orizaba, Vera Cruz,] Mexico.]

Venvidio, IX, 2, 1918, 1 ♂.[16]

The present material differs only from the more detailed description given by Saussure in 1870, in having the head immaculate, lacking "une grande tache brune sur le front entre les antennes."

As the insect is one of the most distinctive forms of the Group Ischnopterae, we note the following additional features for the male. Interocular space slightly less than half as broad as that between the antennal sockets, showing subobsolete impression. Maxillary palpi with third joint three-quarters as long as fifth; fourth half as long as third, expanding strongly, so that the oblique distal and ventral margins are equal in length; fifth joint very large, apex bluntly rounded, entire distal surface deeply concave, fringed along the dorsal margin with hairs. Median segment with two meso-cephalic adjacent tufts of agglutinated hairs. Plate at base of each cercus produced in a moderately curved spine, the sinistral reaching to near the median point of the anal chamber, the dextral decidedly shorter. Subgenital plate with lateral portions well supplied with fine hairs both internally and externally, margin of distal portion armed with an even fringe of closely placed, elongate, chaetiform spines, directed dorsad, and having a brush-like appearance as these spines are partially agglutinated.

*Measurements (in millimeters)*

| | Length of body | Length of pronotum | Width of pronotum | Length of tegmen | Width of tegmen |
|---|---|---|---|---|---|
| Motzorongo, Vera Cruz | 12.1 | 3.1 | 4.2 | 11.8 | 3.8 |
| Motzorongo, Vera Cruz | 12.5 | 3.1 | 4.3 | 11.8 | 3.7 |
| Cuernavaca, Morelos | 14.7 | 3.8 | 5 | 14 | 4.6 |
| Venvidio, Sinaloa | 14.3 | 3.8 | 5.2 | 14.8 | 4.8 |

One of the adults and the immature individual from the State of Vera Cruz lack the heavy distal spines of the ventro-cephalic margin of the cephalic femora. We are unable to account for this, which though apparently having neither generic or specific significance, constitutes a differentiation of a character usually indicating generic distinction.

[16] There are also before us two males from Motzorongo, Vera Cruz, taken in February 1892, by L. Bruner, in the author's collection; one immature male from Vera Cruz, taken by the Rev. T. Heyde in the same collection, and one male from Cuernavaca, Morelos, taken in November, 1905, by Wm. Schaus, in the United States National Museum.

This is the only species of the Group Ischnopterae known to us, where less than three heavy distal spines on the ventro-cephalic margin of the cephalic femora occur. Such a condition is found in about half of the genera of the Group Blattellae. In none of the other American species of the Ischopterae, with which we are familiar, are the tarsal claws asymmetrical. This occurs in a very few genera of the Blattellae.

**Pseudomops septentrionalis** Hebard

1917. *Pseudomops septentrionalis* Hebard, Mem. Amer. Ent. Soc., no. 2, p. 156, pl. VI, figs. 5 to 8. [♂, ♀; Brownsville, Texas.[17]]

Venvidio, VI, 30 to IX, 2, 1918, 18 ♂, 3 ♀.

The present series shows very little color variation. In some the limbs, however, are much darker than in others. The pronotum shows a difference from the usual Texan material in having the lateral and cephalic margins usually very slightly and inconspicuously paler than the adjacent portions, in a few specimens only, is some approach to the Texan series shown in this feature of coloration.

Very close agreement is shown by the general structure, but in one feature of the concealed genitalia we find, in certain individuals only, an extraordinary variation. In this species the paired plate beneath the supra-anal plate has the sinistral portion produced in a large, irregular, lobate patelliform projection, directed mesad, with surface armed with a few minute teeth meso-distad; the dextral portion is produced in a heavier, irregularly rounded patelliform projection, bearing mesad on its ventral surface a large cylindrical process, which, directed ventro-sinistrad, curves weakly sinistrad, tapering to its acute apex.[18] In the Texan material examined, as in individuals of the present series, this is the only process developed on this plate; in other specimens from Venvidio the plate, on the same margin but nearer the base of the dextral style, is produced in another, decidedly smaller, but generally similar process. Differentiation of the concealed genitalia of similar degree, we believe may in most genera be considered as a criterion of full specific differential value. In the present case, however, it appears almost certain that the difference noted is attributable wholly to individual variation.

[17] Material from fourteen Texan localities and from Saltillo, Coahuila, and San José, Tamaulipas, is also recorded.

[18] In our original diagnosis we called this a genital hook, stating that it curved inward, i. e. toward the longitudinal axis of the body.

We have of recent years been giving much attention to the concealed genitalia of the Blattidae and find that in these organs chitinous parts are developed, which frequently afford characters of full specific diagnostic value. These chitinous parts very often are as constant as the specialized portions of the subgenital plate, occasionally they are seen to develop slight individual differences in contour. The present case, however, is the first we have encountered, where a distinct difference is found which we feel obliged to look upon as an individual variation.

NYCTIBORINAE

**Nyctibora tetrasticta** new species (Plate VI, figures 13, 14 and 15.)

This species agrees with *N. truncata* Saussure and Zehntner[20] in being flightless, the tegmina decidedly reduced, the wings represented by vestigial pads. It differs from that species in being somewhat larger, the male sex showing conspicuous abdominal markings.

*Type.*—♂; Venvidio, Sinaloa, Mexico. July 6 to 12, 1918. (J. A. Kusche.) [Hebard Collection, Type no. 760.]

Size small for this genus of large species, slightly larger than *truncata* and *N. azteca* Saussure and Zehntner; surface glabrous, but, thickly supplied with minute, microscopic, procumbent hairs springing from microscopic impressed punctulae. Head elongate and flattened; interocular space narrow, less than one-quarter width between antennal sockets, interocular area flattened, ocellar spots moderately large, not as large or with ocellar areas weakly defined as in *azteca*. Maxillary palpi with fifth joint enlarged, slightly longer than third, fourth half as long as fifth. Pronotum evenly convex, point of greatest width at latero-caudal angles, cephalic margin nearly semicircular to the rounded rectangulate latero-caudal angles, between these the caudal margin is nearly transverse, showing very bread, rounded obtuse-angulation. Tegmina overlapping, somewhat longer than broad, venation subobsolete, the humeral trunk and veins at caudal margin only appreciable unless the tegmina are held up to the light, anal sulcus distinct only at sutural margin, to which margin it is perpendicular; costal margin rounding broadly to sutural margin, so that the median segment only is completely covered. Wings vestigial, represented by lateral pads. Abdominal tergites with caudal margins transverse, fourth tergite with latero-caudal angles weakly acute-angulate produced, fifth and sixth with these angles increasingly produced,

[19] From τετρα-στικτή=four-spotted.

[20] After careful consideration of the description of *Nyctibora (Heminyctibora) truncata*, we feel that Kirby is unwarranted in elevating *Heminyctibora* to generic rank and that the name should be placed in synonymy under *Nyctibora*. The character of reduced organs of flight, alone given as a basis for that name, is insufficient.

dentate. Supra-anal plate roundly produced between cercal bases, showing a weakly triangular tendency, length three-quarters width between cerci. Cerci more compact than in flying species, with dorsal surface weakly convex. Subgenital plate and styles of the general type characteristic of the genus; sinistral style situated proximad, five times as long as greatest proximal width, curving along margin of plate, weakly tapering and flattening at apex; dextral style situated distad, heavier and shorter than sinistral style, similar but enlarging in proximal fifth, less than four times as long as greatest width. Ventro-cephalic margin of cephalic femora armed with (nine to thirteen) small but stout spines, terminating in three spines, elongate in increasing ratio distad; other ventral femoral margins well supplied with heavy spines, those of the caudal margins much more elongate than those of the cephalic margins. Metatarsus unarmed ventrad, four proximal tarsal joints supplied with very large pulvilli. Large arolia present between the stout, asymmetrical tarsal claws.

*Allotype.*—♀; same data as type, but taken June 28, 1918. [Hebard Collection.]

Agrees closely with male, but differing in the following respects. Interocular space narrower, hardly one-fifth as wide as that between antennal sockets. Pronotum broader, with caudal margin even more decidedly transverse, Tegmina nearly as long as broad, sharply truncate distad, leaving the median segment exposed. Supra-anal plate larger, minutely rectangulate emarginate at apex. Subgenital plate large, short, unspecialized.

General coloration shining black, tegmina showing a faint tinge of liver brown. Male with fifth and sixth abdominal tergites showing a large submarginal spot proximad on each side of vinaceous-rufous or ferruginous. Eyes chestnut brown. Antennae black proximad, russet in distal portions. Limbs showing a liver brown tinge distad, pulvilli and ventral surface of arolia buffy. In the female and immature stages the dorsal surface of the abdomen is unicolorous, black. In immatures the head and cerci are deep bay.

In one adult, killed before having become thoroughly hardened, the pronotum is liver brown darkened caudad and latero-cephalad, the tegmina transparent hays russet.

*Measurements (in millimeters)*

| | Length of body | Length of pronotum | Width of pronotum | Exposed length of tegmen | Width of tegmen | Length of caudal femur |
|---|---|---|---|---|---|---|
| ♂ | | | | | | |
| *Type* | 25 | 6.9 | 9.8 | 7.4 | 7.1 | 7.3 |
| *Paratypes*, (5) | 24.5–26 | 6.6–7.2[21] | 9.6–10.1[21] | 7.4–7.8 | 7–7.2 | 7–7.2 |
| ♀ | | | | | | |
| *Allotype* | 24.5 | 7.2 | 10.8 | 7 | 7.6 | 7.2 |

[21] These measurements are for the specimen noted above, which had recently emerged when killed. It is possible that considerable pronotal shrinkage might still have occurred, the pronotum being noticeably larger than in any other male and more of the general form of the female and juveniles.

*Specimens Examined:* 17; 6 males, 1 female, 10 immature individuals.

Rosario, Sinaloa, 3 juv. ♂, 4 juv. ♀.

Venvidio, Sinaloa, VI, 28 to VII, 22, 1918, (J. A. Kusche), 6 ♂, 1 ♀, *type*, *allotype* and *paratypes*, 1 large juv. ♂, 2 large juv. ♀.

BLATTINAE

**Neostylopyga rhombifolia** (Stoll)

1813. [*Blatta*] *rhombifolia* Stoll, Natuur. Afbeeld. Beschr. Spooken etc., Kakkerlakken, p. 5, register p. 14, pl. IIId, fig. 13. [Apparently an immature female, no locality given.]

Rosario, 1 juv. ♂. Mazatlan, XII, 16 to 31, 1916, 2 juv. ♂, 4 juv. ♀. Los Mochis, II, 2, 1918, 1 juv. ♀.

We have previously recorded this species from Escuinapa, Sinaloa.

**Periplaneta americana** (Linnaeus)

1758. [*Blatta*] *americana* Linnaeus, Syst. Nat., Ed. X, p. 424. [America.]

Rosario, 1 ♀. Mazatlan, XII, 16 to 31, 1916, 14 ♂, 4 ♀, 1 juv. ♀. Los Mochis, I, 1 to 2, 1918, 1 ♂, 1 very small juv.

**Periplaneta australasiae** (Fabricius)

1775. [*Blatta*] *australasiae* Fabricius, Syst. Ent., p. 271. ["In nave e mare Pacifico et regionibus incognitis revertente."]

Mazatlan, XII, 16 to 31, 1916, 6 ♂, 1 ♀, 1 juv. ♂.

PANCHLORINAE

**Pycnoscelus surinamensis** (Linnaeus)

1767. [*Blatta*] *surinamensis* Linnaeus, Syst. Nat., Ed. XII, p. 687. [Surinam.]

Rosario, 1 ♀. Mazatlan, II, 21, 1918, 1 ♀; XII, 16 to 31, 1916, 81 ♀, 7 juv. ♀. Venvidio, VI, 30 to VIII, 1918, 11 ♀, 1 juv. ♀. Los Mochis, II, 2, 1918, 2 ♀.

In over a thousand American specimens we have examined, no males have been found. Mr. Wm. T. Davis, however, has secured a single male from the colony at the New York Zoological Park.

It would appear certain that the species is, in America, almost always parthenogenetic.

**Panchlora cubensis** (Saussure)

1862. *P*[*anchlora*] *cubensis* Saussure, Rev. et Mag. de Zool., (2), XIV, p. 230. [♀, Cuba.]

Venvidio, VI, 31 to VIII, 10, 1918, 8 ♂, 1 ♀.

**Panchlora cahita** new species (Plate VII, figure 1.)

This handsome insect belongs to the green species of the genus, with antennae showing a single dark annulus, but pronotum without narrow dark lateral lines.

The tegmina, lacking dots and lines, and heavier limb armament, distinguish it from *P. fraterna* Saussure and Zehntner, *hyalina* Saussure and *festae* Giglio-Tos. In this it agrees only with *P. acolhua* Saussure and Zehntner, now known from the States of Guerrero and Chiapas, from females only. The present insect is separable from that species by its narrower form and much narrower tegminal marginal field. Males of *acolhua* will probably show additional features of difference.

A single female is in the Academy Collection from Guadalajara, Jalisco, taken by D. L. Crawford, which we refer to the present species with some uncertainty. It is readily distinguished from the female of *acolhua* recorded recently by us,[22] by the characters mentioned above and the more strongly bilobate supra-anal plate.[23]

*Type.*—♂; Venvidio, Sinaloa, Mexico. August 18, 1918. (J. A. Kusche.) [Hebard Collection, Type no. 761.]

Size medium, form broad for the genus. Head with eyes rather narrow in front, considerably narrower than in *P. cubensis* Saussure; separated by a moderately broad space, slightly over half the occipital ocular depth.[24] Pronotum broad for the genus, the lateral portions not clear, transparent but tinged with greenish, the marginal field filled with a network of coarse, opaque greenish veinlets.[25] Supra-anal plate strongly bilobate. Cerci small, extending very slightly beyond the apex of the produced supra-anal plate, tapering distad, the last joint flattened, elongate-triangular, with apex sharply rounded. Subgenital plate transverse, asymmetrical, the sinistral portion

[22] Trans. Amer. Ent. Soc., XLVII, p. 213, (1921).

[23] In this specimen the interocular space is hazel, the face mesad and dorsal margins of the femora suffused with chestnut brown, while the antennal annulus occupies sixteen joints. The measurements are, for this female: length of body, 23; width of interocular space, 1; length of pronotum, 6.2; width of pronotum, 8.7; length of tegmen, 21.8; width of tegmen, 8; width of tegminal marginal field, 1.7 mm. Additional material is needed to determine whether these features indicate specific differentiation or are due only to individual variation.

[24] Varying in the series from slightly less to decidedly greater than half that dimension.

[25] Varying in intensity in the series and in rare examples absent from the larger portion of this field.

roundly produced but showing a slight truncation, so that its free margin in large part coincides with that of the sinistral lobe of the supra-anal plate, this production with surface broadly concave and hairy, the free margin thence transverse to the dextral style, situated at the dextral base of the plate. Styles simple, elongate, cylindrical and similar, situated on the free margin of the subgenital plate at the inner margin of the cerci and equal to half the length of the exposed portion of the cercus (or slightly more elongate). Cephalic femora with a fringe of hairs on ventro-cephalic margin, other ventral femoral margins with a single heavy and moderately elongate distal spine, except caudal margin of caudal femora which bears no distal spine. Large pulvilli present on four proximal tarsal joints. Moderately large arolia present between the symmetrical tarsal claws, which have no internal flange, but have the internal margin microscopically serrulate.

Dorsal surface rich tiber green,[27] fading toward hyaline laterad on pronotum, in tegminal marginal field and between veins distad on tegmina, area between mediastine and humeral veins often very slightly yellowish. Head ocher red, frequently paling to buffy on face. Eyes blackish brown. Antennae light ochraceous-tawny, with a blackish brown annulus in distal portion including five (normal in series, varying to nine) joints. Limbs and abdomen probably green-yellow in life, the former buffy except distad in dried material.

The measurements of the type are given first, followed by the extremes in the paratypic males. Length of body, 14.5, 13.2 to 15.9; length of pronotum, 4.9, 4.8 to 5.2; width of pronotum, 6.3, 6.2 to 6.7; length of tegmen, 17, 15.6 to 17.3; width of tegmen, 5.9, 5.7 to 6; width of tegminal marginal field, 1.1, 1 to 1.1 mm.

In addition to the type, a series of forty-seven paratypic males are before us, bearing the same data, except that they were taken from July 28 to September 2, 1918.

**Panchlora montezuma** Saussure and Zehntner

1893. *Panchlora montezuma* Saussure and Zehntner, Biol. Cent.-Amer., Orth., 1, p. 98. [♂, ♀; Presidio of Mazatlan, [Sinaloa,] Mexico.]

Villa Union, IX, 27, 1918, 7 ♂, 2 ♀. Venvidio, VI, 16 to VIII, 12, 1918, 51 ♂, 14 ♀.

The original description is apparently carelessly drawn in some respects. The interocular space in males before us is narrow, varying from less than one-sixth to one-fifth the occipital ocular depth. The antennae are blackish brown, becoming pale, ochraceous-tawny, mesad and at the tips, rarely the median portion is also dark, while occasionally the proximal portion is

[26] In the series very rarely showing a very minute, stout spine mesad on this margin.

[27] A deeper green than in *cubensis* and its allies.

scarcely darker than the median pale portion. The pronotum is immaculate in all but a few females, where a pair of median flecks of brown appear, varying from subobsolete to distinctly indicated. The males average paler with pronotum and tegmina warm buff, the former often showing a faint greenish tinge. The darker females have the pronotum largely ochraceous-buff tinged with tawny, the mesonotum and metanotum with extensive suffusions and all but narrow periphery of abdomen solidly chestnut brown, this showing through, particularly caudad of the pronotal disk and mesad in anal fields of tegmina when they are at rest. Two flecks of dark brown are found distad on each tegmen, these are very greatly reduced but persist even in the males of maximum recessive coloration.

**Nauphoeta cinerea** (Olivier)

1789. *Blatta cinerea* Olivier, Encycl. Method., Ins., IV, p. 314. [Adults and juv.; "L'Ile de France" (= Mauritius).]

Rosario, 2 small juv.

CORYDIINAE

**Holocompsa scotaea** new species (Plate VII, figures 2 to 5.)

Closely related to *H. nitidula* (Fabricius), the present species differs in the slightly more metallic blue-black general coloration, solidly darkened transparent portions of the tegmina and decidedly less contrast in coloration between the sexes. In *scotaea* the male has the pronotum dark, with small areas of tawny latero-cephalad, the female has the pronotum dark, with lateral portions ochraceous-tawny. Recession in coloration apparently results in the pronotum of females being sometimes ochraceous-tawny laterad and cephalad, the dark portion reduced to a roughly triangular area meso-caudad, occupying only a third of the pronotal surface.

*Type.*—♂; Venvidio, Sinaloa, Mexico. June 24, 1918. (J. A. Kusche.) [Hebard Collection, Type no. 763.]

Size very small, slightly larger than *nitidula;* form elliptical, tegmina and wings projecting slightly beyond apex of abdomen. Head fully as broad as long, eyes very widely separated, above not extending inward beyond antennal bases; ocelli minute, oval, with surfaces convex; occiput supplied with minute hairs, these fewer on face, which shows a weak vertical linear sulcus mesad. Pronotum as in *nitidula;* thickly supplied with minute procumbent hairs and

laterad with longer erect hairs. Tegmina proximad opaque and thickly supplied with similar hairs, bounded by a nearly straight, oblique line from apex of anal field to distal portion of costal margin; remaining portion delicate, suffused hyaline. Wings delicate, hyaline, with two elongate, adjacent, translucent stigmata at costal margin. Cerci with (seven) strongly defined rounded joints, none much longer than broad, tapering to acute apex. Supra-anal plate delicate, sub-bilobate in caudal outline. Subgenital plate somewhat asymmetrical, bilobate, with two very small, simple, straight, elongate, cylindrical styles. Limb armament, pulvilli and arolia as characteristic of the genus.

*Allotype.*—♀; same data as type. [Hebard Collection.]

Agrees with male except as follows. Size larger, form broader, with tegmina and wings extending to apex of abdomen. Ocelli elliptical. Supra-anal plate more chitinous, half as long as width between cercal bases, produced between these and broadly rounding to the broadly transverse distal portion. Subgenital plate valvular, as characteristic of the genus.

The coloration of this species, as in other forms of the genus, affords the specific diagnostic characters of greatest importance. Male. Head blackish brown, mouthparts paler. Antennae blackish brown, with a buffy annulus distad, which occupies three to four joints. Underparts and limbs blackish brown, the latter with trochanters and joints paler, spines ochraceous-tawny. Pronotum black with a weak metallic bluish sheen, proximo-lateral portions narrowly ochraceous-tawny (in a male paratype this extends to the latero-caudal angles). Tegmina in proximal portions black with a metallic bluish sheen (but when held to light translucent prout's brown); in distal portions transparent, evenly suffused with prout's brown. Wings with stigmata translucent prout's brown, remaining portions hyaline, very faintly washed with prout's brown, except distal portion of anterior field and peripheral margin of radiate field where they are suffused with this color. Dorsal surface of abdomen and cerci shining blackish brown.

Female. Differing from the male in color only as follows. Antennae with a buffy annulus occupying six or seven joints. Ochraceous-tawny lateral portions of pronotum extending to near the latero-caudal angles, in one recessive specimen more orange in shade, including these angles and leaving only the meso-caudal third of the pronotum black. Tegmina with metallic bluish sheen of proximal portions more pronounced.

*Measurements (in millimeters)*

| ♂ | Length of body | Length of pronotum | Width of pronotum | Length of tegmen | Width of tegmen |
|---|---|---|---|---|---|
| *Type* | 5.8 | 1.8 | 2.2 | 4.9 | 2 |
| *Paratype* | 6 | 1.8 | 2.1 | 4.9 | 2 |
| ♀ | | | | | |
| *Allotype* | 7.2 | 2.2 | 2.8 | 5.8 | 2.7 |
| *Paratypes* (3) | 6–6.4 | 1.9–2 | 2.2–2.9 | 5.3–5.8 | 2.2–2.7 |

In addition to the described pair, we have before us one male and three female paratypes, bearing the same data.

**Compsodes schwarzi** (Caudell)

1913. *Latindia schwarzi* Caudell, Proc. Ent. Soc. Washington, v, p. 165. [♂; Madero Canyon, Santa Rita Mountains, Arizona.]

Venvidio, VI, 24 to VIII, 10, 1918, 10 ♂.

These specimens are all decidedly darker than any others we have seen, being bister to very dark bister in general coloration. This intensification of coloration may be ascribable to the somewhat less arid environment in which this series was probably secured.

**CALOBLATTA** Saussure

1893. *Caloblatta* Saussure, Societas Entomol., p. 57.

1893. *Caloblatta* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 33.

We are convinced that Saussure, misled by a certain amount of superficial resemblance to *Thyrsocera*, incorrectly referred this genus to the Pseudomopinae.

Through differing to an extreme degree in wing venation, as well as in pronotal contour and in other less important features, nearest relationship is apparently with that section of the Corydiinae which includes *Hypnorna* and its allies.

The material now before us, when compared with the second, more detailed, description of *Caloblatta*, differs in having the caudal margin of the pronotum very broadly convex, showing scarcely a trace of any "very weak median production"; the veins of the discoidal field of the tegmina are not all longitudinal, as these discoidal sectors become weakly oblique toward the sutural margin, while weak spines are present on all the ventral femoral margins.

We here select the Costa Rican *C. bicolor* Saussure as genotype of *Caloblatta*. Examination of the type or additional material, we believe, will show the species described below to be congeneric, in spite of the apparently important differences noted above.

**Caloblatta lampra** new species (Plate VII, figures 6 and 7.)

The antennae without annuli and rich ferruginous pronotum of this insect, with area between the latero-caudal sulci of the disk suffused with carob brown, readily distinguish it from its nearest relative, *C. bicolor* Saussure, described from Costa Rica.

*Type.*—♂; Venvidio, Sinaloa, Mexico. July 6 to 12, 1918. (J. A. Kusche.) [Hebard Collection, Type no. 764.]

Size large for this group of small insects, form slender. Head with width between antennal sockets equal to three-quarters of the interocular width; interocular-ocellar area flattened, shagreenous and with irregular shallow impressions, this area forming a sharp rectangle with the dorsal margins of the ocelli; ocelli large, with flat surfaces vertical. Maxillary palpi rather short, enlarged fifth joint nearly as long as combined length of second and third joints, fourth joint two-thirds as long as third. Antennae setaceous, the setae slightly longer and heavier in the proximal, moderately incrassate half. Pronotum symmetrically trapezoidal, weakly transverse, latero-caudal angles broadly rounded, latero-cephalic angles still more broadly rounded, cephalic and caudal margins transverse, very broadly convex; latero-caudal sulci of disk pronounced, giving the intervening area a greater convexity. Tegmina and wings fully developed, extending slightly beyond cercal apices. Tegmina elongate, subparallel to the broadly rounded apex; discoidal sectors weakly radiating, so that those toward the discoidal vein are parallel to it, those toward the sutural margin weakly oblique to that margin. Wings elongate and rather narrow, radiate field folding fan-wise; numerous (fourteen) costal veins thickened to near bases, unbranched median vein connected with discoidal vein by a number of transverse veinlets, ulnar vein with (two) complete distal and several irregular incomplete proximal branches, intercalated triangle obsolete. Dorsal surface of abdomen[28] with eighth tergite narrowly visible except laterad, where it is symmetrically and triangularly produced and folded about the lateral portions of the base of the subgenital plate, dorso-mesad with a low triangular conical projection, the preceding (seventh) tergite narrowly visible laterad and emarginate to the caudal margin of the sixth tergite mesad, which margin, in consequence, is adjacent to the conical projection of the eighth tergite. Supra-anal plate transverse, broadly and roundly triangularly produced between cercal bases with distal portion decurved. Subgenital plate with sinistral margin briefly oblique below sinistral cercus, then briefly transverse where mesad is situated the sinistral style, beyond in remaining two-thirds broadly and slightly irregularly angulato-convex, with dextral style situated at apex. Styles small, simple, cylindrical, unarmed; the sinistral slightly tapering and very weakly decurved, slightly over twice as long as its proximal width; the dextral scarcely tapering, slightly heavier and shorter, but otherwise similar. Limbs slender. Ventro-cephalic margin of cephalic femora armed with large but delicate spines proximad, succeeded by a row of minute, piliform spines, terminating distad in two large but delicate spines, the more distal of which is the longer by a third; ventro-caudal margin unarmed except for a single delicate distal spine. Other femora with a delicate genicular spine and ventral margins armed with a similar distal and one to three other smaller, delicate spines, these short on

[28] As has been our custom, we count the ten dorsal abdominal segments as follows; median segment, first to eighth tergites, supra-anal plates.

cephalic margins, longer on caudal margins. Small distal pulvilli present on the four proximal tarsal joints. Small arolia present between the bases of the delicate, simple, symmetrical tarsal claws.

Head and palpi blackish brown, ocelli buffy. Antennae blackish brown, shading to hazel in distal fourth. Pronotum ferruginous, suffused with carob brown between the latero-caudal sulci of the disk, this forming a poorly defined, short, broad, V-shaped marking. Tegmina very weakly translucent, dull carob brown, very narrow marginal field light ochraceous-buff, this continued along costal margin but narrowing and disappearing toward apex, sutural margin of sinistral tegmen more broadly margined with ochraceous-buff for an equal distance. In some specimens these marginal areas are weakly suffused with tawny and are about equal in width. Abdomen and cerci blackish brown. Limbs part pale and part dark, ochraceous-buff, often tinged with tawny or blackish brown; cephalic coxae light with a proximal dark fleck, median and caudal coxae dark in nearly all of proximal half. Trochanters and over proximal half of cephalic femora pale, remaining portions dark; median and caudal femora similar but with less than proximal half pale. Tibiae and tarsi dark, spines ochraceous-buff tinged with tawny.

The measurements of the type are given first. Length of body, 10.5, 9.2 to 10.9; length of pronotum, 2.9, 2.7 to 2.9; width of pronotum, 3.3, 3 to 3.3; length of tegmen, 10. 9 to 10.3; width of tegmen, 3, 2.8 to 3.1 mm.

In addition to the type, a series of five male paratypes, bearing the same data but taken June 24 to July, 12, 1918, are before us.

OXYHALOINAE

**Chorisoneura anisoura**[29] new species (Plate VII, figure 8.)

Belonging to the Pellucida Group,[30] the present species is smaller, with tegmina less elongate than the previously known forms. In addition, the asymmetrical specialization of the male styles is of a type hitherto unknown.

*Type.*—♂; Venvidio, Sinaloa, Mexico. July 28 to August 1, 1918. (J. A. Kusche.) [Hebard Collection, Type no. 765.]

Size medium large for the genus, decidedly smaller than in *C. pellucida* Saussure; form depressed, in outline elliptico-ovoid. Head broad, decidedly depressed; from the dorsum the occiput and cephalic half of the eyes are seen to be exposed, occipital outline truncate, the eyes not projecting beyond the interocular area; interocular space broad, one and one-third times occipital ocular depth, nearly four-fifths as wide as width between antennal sockets. Maxillary palpi with fourth joint three-quarters as long as the elongate third joint, fifth joint slightly shorter than fourth. Pronotum transverse elliptical,

[29] From ἄνισῃ + οὐρὰ, in allusion to the remarkably unequal styles of the male subgenital plate.

[30] Erected and discussed, Mem. Amer. Ent. Soc., no. 4, p. 128, (1920).

with lateral portions broad, as is characteristic of this group of *Chorisoneura*. Tegmina elongate, though not as elongate or as acute at apex as in *pellucida*, extending to apices of cerci; marginal field very broad, apex sharply rounded, moderately acute; discoidal vein with numerous branches and false nervures toward costal margin, discoidal sectors (fourteen, counting the numerous supplementary branches) oblique. Wings with intercalated triangle acute-angulate proximad, numerous costal veins heavily and briefly clubbed distad; discoidal and median veins connected by transverse veinlets; ulnar vein branching distad. Sixth dorsal abdominal segment with a very large, round, slightly impressed area mesad, its surface well supplied with minute, microscopic, procumbent hairs. Supra-anal plate nearly one-third as long as basal width, triangularly produced between cerci with apex truncate, subbilobate. Subgenital plate asymmetrical (see plate VII, figure 8); sinistral style situated slightly sinistrad of median point, a deeply inset broad lobe with apex rounded,[31] upon dissection its internal surface is seen to be concave, its margins free except sinistrad, these margins proximad and dextrad fringed with very minute, nearly procumbent, chaetiform spines; dextral style dextrad of and touching the dextral margin of the sinistral style, considerably more produced caudad, a finger-like process, bent mesad with distal half directed caudad, the apex slightly thickened with margin rounded, upon dissection its internal surface is seen to be concave;[32] the internal surface of the plate is also deeply concave toward the sinistral and dextral margins, these marginal portions separated from the remaining broadly concave surface by decided, lamellate, somewhat irregular ridges. Limb armament, pulvilli, tarsal claws and arolia as characteristic of the genus.

Head with vertex ochraceous-buff, shading to ochraceous-tawny, this extending to just before narrowest point between eyes, where it is in abrupt contrast with the light buff inter-ocular-ocellar area. In this intersection are two (often obscured) dots of prout's brown.[33] Antennae, remaining portions of face and palpi warm buff. Pronotum with hexagonal disk ochraceous-buff very faintly tinged with tawny, lateral portions transparent showing a very faint brownish buffy tint. Scutellum with a moderately large median dot of light buff. Tegmina with marginal and external two-thirds of scapular fields as lateral portions of pronotum, remaining portions with veins and veinlets buffy, the remaining portions transparent tinged with ochraceous-tawny. Wings transparent washed weakly with ochraceous-tawny, this

[31] Giving the appearance of the apical portion of the plate, separated from the other portions by a suture.

[32] In the series slight irregularities in the contour of the lobiform sinistral and finger-like dextral style is shown, their general type remaining, however, the same.

[33] The whitish area is immaculate in the type, but in the majority of the series two similar, but much more widely separated, dots of prout's brown are found just below, and in some individuals two more similar dots occur just below these, still more widely separated and touching the margins of the eyes.

more decided in area of costal veins and distad in anterior radiate fields. Ventral surface and limbs translucent ochraceous-buff, the sternites heavily suffused with opaque light buff.

In coloration this species apparently closely resembles *pellucida*. It is the same generally as in *C. panamae* Hebard, which species is, however, more richly colored with pronotal disk not unicolorous and showing other minor differences.

The measurements of the type are given first. Length of body, 9.4, 9 to 9.7; length of pronotum, 2.2, 2 to 2.2; width of pronotum, 3.4, 3.2 to 3.4; length of tegmen, 9, 8.7 to 9.5; width of tegmen, 3, 2.9 to 3.1 mm.

In addition to the type, a series of six male paratypes, bearing the same data but taken from June 30 to August 6, 1918, has been examined.

**Chorisoneura flavipennis** Saussure and Zehntner

1893. *Chorisoneura flavipennis* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 81, pl. II, fig. 21. [♂; Atoyac, Vera Cruz, Mexico.]

Venvidio, VI, 30 to IX, 2, 1918, 17 ♂, 2 ♀.

These specimens appear to agree in all important respects with material recorded from Guatemala and Costa Rica,[34] at which time the Flavipennis Group was proposed and *C. fuscipennis* Hebard compared with the present species. Both these species have the median portion of the plate between the bases of the styles produced dextrad in a small, stout spine, which curves caudad. The styles in *flavipennis* are broader and more lamellate.

The species is very plainly colored, the head immaculate[35] and the general tone of coloration more reddish than in *C. translucida* Saussure and its allies.

## Mantidae

### EREMIAPHILINAE

**Mantoida maya** Saussure and Zehntner

1894. *Mantoida maya* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 125, pl. II, figs. 26 and 27. [♀; Temax, Yucatan, [Mexico].]

Venvidio, VII, 6 to IX, 2, 1918, 12 ♂.

This series averages larger than the only other males we have seen, one from Panama, the other from Colombia. Careful

[34] Mem. Amer. Ent. Soc., no. 4, p. 131, (1920).

[35] In the majority of the series the interocular area is unicolorous. In a few specimens, however, there is a very weak indication of a broad, very slightly darker, band.

examination fails to reveal other features of diagnostic value, however, and we believe that these all represent the same species.

In the material here recorded the pair of heavy dark bands on the occiput vary in intensity. In some these bands are obsolete on the pronotum, but in the majority of specimens they heavily suffuse all of the lateral portions of the pronotum on each side. In this series the cephalic coxae are buffy, the median and caudal limbs more reddish. The cephalic trochanters, proximo-internal portion of the cephalic femora and external surface of the same are conspicuously darkened to varying degrees, the external surface of the cephalic tibiae but slightly paler. The tarsi are sometimes unicolorous, sometimes darkened at the apices of the joints.

Each series, of the four from widely separated localities before us, representing *maya*, shows certain color differences and those noted here, which do not all agree with the type, undoubtedly constitute only local color adaptations of no specific or racial significance.

Length of body, 16 to 17.7; length of antenna, 24.5 to 25.7; length of pronotum, 2.3 to 2.3; width of pronotum, 2.1 to 2.2; length of tegmen, 16.2 to 16.7; length of caudal femur, 5.7 to 6.3 mm.

AMELINAE

**Yersinia mexicana** (Saussure)

1859. *A[canthops] mexicanus* Saussure, Rev. et Mag. de Zool., (2), XI, p. 60. [♂ (nec larva); [Michoacan,] Mexico.]

Venvidio, VIII, 2 to IX, 2, 1918, 12 ♂, 5 ♀. Villa Union, II, 21 and IX, 27, 1918, 1 ♂, 1 ♀.

This handsome species was subsequently fully described by Saussure.[36] The specimens before us are all brown, some pale and immaculate, others variable, darker with flecks of dark brown. The cephalic coxae are sometimes immaculate, but usually have a row of dark flecks on the dorso-internal margin and rarely a dark suffusion distad. The cephalic femora are rarely immaculate, usually having on the internal surface a large, shining, roughly square, black marking at the unguicular

[36] Mém. l'Hist. Nat. Mex., IV, Mantides, p. 99, pl. 1, figs. 14, 14a and 15, (1871).

sulcus and a smaller similar marking in the area of the femoral brush. The great variation exhibited in these features shows the folly of attempting to separate as species, individuals of the Mantidae differing only in such, or analogous, color characters.

Though previously known only from the originally described material, there are, in addition, in the author's collection a male from Aguascalientes, taken in November, 1887, by L. Bruner, and two females, one from Rio Cocula, Guerrero, the other from Tepic. This male has the eyes slightly more acute, with their dorsal margins slightly ascending, so that the head does not appear as nearly transverse dorsad as in the Sinaloa series. This we believe to be wholly attributable to individual variation, though large series may prove geographic racial differentiation.

### OLIGONICINAE

**Oligonicella mexicana** (Saussure and Zehntner)

1894. *Oligonyx mexicanus* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 172, pl. IX, figs. 13 to 15. [♂: Presidio [of Mazatlan, Sinaloa], Mexico; Cubulco, Vera Paz, Guatemala.]

1894. *Oligonyx toltecus* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I. p. 175. [♀; Chilpancingo, Guerrero, Mexico.]

At the time *toltecus* was described, the authors noted the possibility of its representing the opposite sex of *mexicanus*.[37]

Venvidio, VI, 16 to IX, 2, 1918, 14 ♂, 1 ♀. Los Mochis, XII, 1917 and I, 1 to 2, 1918, 3 ♂.

A pair of this species from Tepic is also in the collection of the author.

The measurements of the extremes in the present series are: length of body, ♂ 37 to 42.7, ♀[38] 37.2 to 44.8; length of pronotum, ♂ 9 to 10.7, ♀ 11.3 to 14; greatest width of pronotum, ♂ 1.9 to 2, ♀ 2.2 to 2.4; length of tegmen, ♂ 20 to 22; length of supra-anal plate, ♂ 1.7 to 1.7, ♀ 2.1 to 2.2; length of cephalic femur, ♂ 6.4 to 7.8, ♀ 8.1 to 9.3 mm.

[37] Saussure and Zehntner give 3.2 mm. as the length of the supra-anal plate for *toltecus*. This is either in error or very decided individual variation occurs, as we have found to be true of females of certain other species of this group.

[38] The larger female is from Venvidio.

**Oligonicella tessellata** (Saussure and Zehntner)

1894. *Oligonyx tessellatus* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 174, pl. IX, figs. 26 to 31. [♂; Omilteme, Guerrero, Mexico.]

Venvidio, VI, 16 to VII, 22, 1918, 4 ♂.

The variation shown by the present series might indicate the synonymy of this name under *O. punctulatus* (Saussure and Zehntner), described from Dos Arroyos, Guerrero, Mexico. If the figures are correct, however, *punctulata* is a decidedly more slender insect.

Measurements of males: length of body, 26 to 28.9; length of pronotum, 5.2 to 6; greatest pronotal width, 2.2 to 2.6; length of tegmen, 18 to 19.6; greatest width of tegmen, 5.2 to 5.8; length of cephalic femur, 5.3 to 6 mm.

An immature female from Sierra Laguna, Baja California, is also in the author's collection.

MELLIERINAE

**Melliera atopogamia** Saussure

1892. *Melliera atopogamia* Saussure, Societas Entomol., VII, p. 123. [♂, ♀; Sinaloa, Mexico.]

Venvidio, VII, 6 to VIII, 1, 1918, 3 ♂. Los Mochis, XII, 29, 1917, 2 ♂.

This remarkable species has subsequently been fully described and both sexes figured by Saussure and Zehntner,[39] who recorded additional material from San Isidro, Guatemala and Chontales, Nicaragua.

MANTINAE

**Stagmomantis tolteca** (Saussure)

1861. *Mantis (Stagmatoptera) tolteca* Saussure, Rev. et Mag. de Zool., (2), XIII, p. 127. [[♀], "Mexico calida."]

Venvido, VII, 28 to VIII, 10, 1918, 5 ♂. Los Mochis, XII, 28, 1917, 1 large juv. ♂.

The proportionately more slender pronotal shaft is the most conspicuous feature to separate males of the present series from males of the very closely related *S. carolina* (Johannson), from the eastern United States.

[39] Biol. Cent.-Amer., Orth., I, p. 149, pl. VII, figures 7 and 8, (1894).

Careful comparison of large series of these species will have to be made before the best diagnostic characters can be tabulated. We are satisfied that distinct species are represented, but so close are they that apparent features of difference between individual series may not be as useful as they seem, when comparison is made with still other series.

**Stagmomantis limbata** (Hahn)

"1836. *Mantis limbata* Hahn," Icones Orth. 1, pl. A, gen. *Mantis*, fig. 2." [Mexico.]

Venvidio, VI, 24, to IX, 2, 1918, 30 ♂. Mazatlan, XII, 28, 1916, 1 ♀. Los Mochis, XII, 2 to 29, 1917, 3 ♂, 1 ♀. Villa Union, IX, 27, 1918, 1 ♀.

This series shows considerable size and color variation. The majority of the males and all of the females have the cephalic femora immaculate. In the other males these members have three broad, transverse bands of darker shade, which are very decided in the individuals which have head, pronotum and limbs brown instead of green. The males have the tegminal marginal field opaque, usually solid green, sometimes this is narrowly bordered proximad at the mediastine vein with white, while in one brown male the entire field is white tinged with yellowish green, in another brown male it is entirely white. In all the abdomen is immaculate dorsad. The males have, at the stigma of the tegmina, a small blotch of translucent sepia, this reduced to very small size in a few specimens and obsolete in one. In this sex the transparent wings are marked with numerous paired flecks of translucent sepia in the caudal portion of the radiate field.

The extremes in size are shown by the following measurements (in millimeters).

| | Length of body | Length of pronotum | Width of pronotal supra-coxal expansion | Length of tegmen | Width of marginal field of tegmen |
|---|---|---|---|---|---|
| ♂ | | | | | |
| Venvidio (30) | 46–59.8 | 15–19.8 | 3.2–4.1 | 33.9–42.8 | 2.1–2.8 |
| Los Mochis | 46–50 | 14.7–16.4 | 3.1–3.6 | 32–36.4 | 2.1–2.3 |
| ♀ | | | | | |
| Mazatlan | 53.3 | 20 | 5.1 | 24.7 | 3.7 |
| Los Mochis | 43 | 15.9 | 4.2 | 20 | 2.2 |
| Villa Union | 53.7 | 19.9 | 5.2 | 25.9 | 3.8 |

In addition to the material from the collection under consideration, we have examined 2 ♂, 1 ♀, from San Pedro Martir, Baja California; 1 ♂, Sierra el Taste, Baja California, and 3 ♂, 11 ♀, from San José del Cabo, Baja California.

**Stagmomantis colorata** new species (Plate VII, figure 9.)

Nearest relationship is apparently with *S. californica* Rehn and Hebard,[40] agreement being found in the type of the male stigma, the banded abdomen,[41] features of the supra-anal and subgenital plates and female head and tegmina. The much larger size, opaque, unicolorous and gradually narrowing marginal field of the male tegmina and other less striking features serve to separate these species.

At first glance individuals of *colorata* somewhat resemble large individuals of *S. limbata* (Hahn). Males are quickly distinguished by their larger size, costal margin of tegmina which is proportionately narrower proximad and narrows much more gradually, proximal abdominal tergites the blackish brown caudal portions of which form broad and striking transverse bands, tegmina which lack stigmal markings and wings which are entirely suffused with dark brown except for irregular pale patches in the anterior field, particularly distad, and the colorless transverse veinlets of the radiate field.

The single female before us has the appearance of a gigantic female of *S. carolina* (Johannson), but the facial scutellum is as high as in this sex of *limbata* and the pronotal shaft is more strongly medio-longitudinally carinate. This specimen is very dark, the stigmal smooth area even darker than the other portions of the tegmina and the transverse bars on the proximal abdominal tergites very broad, but showing by no means as great color contrast as in the males.

In both sexes the spines of the cephalic coxae are pale, while the cephalic femora have a small fleck of blackish brown at the unguicular sulcus.

[40] One male from Sierra el Taste, Baja California and three males from San José del Cabo, Baja California are before us. These represent the first records of *californica* from outside the United States.

[41] In the green phase of *californica* the cephalic tarsal joints show distad on their internal surfaces only weak suffusions of brown, though in the brown phase these are as strong as in the individuals of *colorata* before us, all of the latter representing the brown phase.

*Type.*—♂; Villa Union, Sinaloa, Mexico. September 27, 1918. [Hebard Collection, Type no. 865.]

Size large, form elongate. Head as in *limbata*, except that the dorsal angle of the facial scutellum is evenly rounded, not bilobate. Pronotum with lateral margins smooth, except on collar where they are very feebly sub-denticulate; supra-coxal expansion moderate, as in *limbata;* shaft with a decided medio-longitudinal carina. Tegmina with marginal field opaque, rather narrow and narrowing very gradually and evenly from proximal point of greatest width, stigma neither defined in color nor with an adjacent suffusion. Abdomen with proximal tergites dark distad, forming broad bands. Supra-anal plate transverse, weakly chitinous toward the broadly convex free margin. Concealed genitalia apparently as in *limbata*, except that the heavy spine of the ventral lobe, similarly directed dextro-proximad, is decidedly more elongate. Subgenital plate truncate distad, with a minute median angulate emargination, so that, unlike *limbata*, each style surmounts a small rotundato-truncate lobe; these lobes are symmetrical, the dextral narrower but projecting further than the sinistral. Cephalic coxae reaching to proximal third of pronotal shaft, cephalic margin armed with (six to nine in the series) small, bluntly rounded spinulae, between which are irregularly scattered a few very minute tuberculations. Caudal metatarsus shorter than combined length of succeeding joints.

*Allotype.*—♀; Venvidio, Sinaloa, Mexico. August 28, 1918. (J. A. Kusche.) [Hebard Collection.]

Size very large, form elongate for this sex of *Stagmomantis*, though much heavier than male. Head much as in this sex of *limbata*, except that the occiput is more elevated, with vertical impressions more prominent and dorsal outline between juxta-ocular portions showing even weaker convexity, while the facial scutellum is very slightly higher.[42] Pronotum with lateral margins finely denticulate on collar, this becoming much weaker on shaft; supra-coxal expansion slightly greater than in females of *limbata* and narrowing more rapidly caudad, sulci and carina stronger than in male. Organs of flight reduced, covering slightly more than proximal half of abdomen. Tegmina opaque, stigma indicated by a smooth oval, longitudinal area, costal margin comparatively narrow and narrowing very gradually distad. Bands of proximal abdominal tergites broader, but less conspicuous, than in male. Cephalic coxae reaching to near caudal extremity of pronotal shaft, cephalic margin armed with (eight and eleven) spinulae, which are slightly heavier than in male but of the same type, between which are irregularly scattered a larger number of very small spinulae.

Coloration. Male. Head, pronotum and body light brown. Cephalic femora with a small blackish brown fleck at unguicular sulcus; external surfaces often showing three very broad transverse bands of (individually

[42] The difference in this respect is so slight that it will probably be found to have little or no diagnostic value.

varying shades of) brown. Cephalic tarsal joints each marked distad, on internal surface, with a heavy fleck of blackish brown[43]. Median and caudal limbs light green or brown. Abdomen always with proximal tergites shining and each heavily blackish brown distad, this forming very conspicuous broad, transverse bands. Tegminal marginal field opaque, light green; remaining portions transparent, colorless except for scattered flecks of brown proximad and much more numerous, fusing, similar suffusions toward the marginal field. Wings with anterior field transparent, colorless with brown flecks distad, which fuse proximad, leaving only irregular paler yellowish brown patches between; radiate field transparent, metallic purplish-black, with minute, transverse veinlets pale, and a paler pinkish area at base.

In a very recessive paratype from San José del Cabo, the tegmina show no brown suffusions, but the wings and abdomen are as strikingly colored as in the type.

Female. Brown phase. Markings of cephalic femora and tarsi as in males, abdominal bands broader but much less contrasting, bister. Tegmina opaque, bone-brown; stigma shining and still darker.

*Measurements (in millimeters)*

| | Length of body | Length of pronotum | Width of pronotal supra-coxal expansion | Length of pronotal shaft | Length of tegmen | Width of tegminal marginal field |
|---|---|---|---|---|---|---|
| ♂ | | | | | | |
| Villa Union, *type* | 69.5 | 22.7 | 4.2 | 17.4 | 44.7 | 2.2 |
| Tepic, *paratype* | 58 | 20.3 | 4.2 | 15.7 | 46 | 2.2 |
| Tepic, *paratype* | 61 | 20.2 | 4.2 | 15.4 | 44 | 2.4 |
| San José del Cabo, *paratype* | 66 | 21.7 | 4.4 | 16.8 | 50.2 | 2.4 |
| ♀ | | | | | | |
| Venvidio, *allotype* | 83.5 | 30.7 | 7.7 | 22.9 | 29 | 2.8 |

In addition to the described pair, two paratypic males from Tepic, a paratypic male from San José del Cabo, Baja California, and three large immature individuals (two males and one female) from Venvidio, Sinaloa, taken August 18 and 28, 1918, by J. A. Kusche, are in the author's collection.

EPAPHRODITINAE

**Acanthops bidens** new species (Plate VII, figures 10 and 11.)

This handsome species is readily distinguished by the dentate production of each juxta-ocular area of the occiput. It is apparently nearest the Honduran *A. godmani* Saussure and Zehntner,

[43] In species of *Stagmomantis* such marking often disappears in specimens of strong recessive coloration. This character is, therefore, of highly uncertain specific diagnostic value, and Giglio-Tos' recent use of it in that sense has probably resulted in the erection of one or more synonyms.

differing further in the proportionately shorter pronotum and tegmina which are moderately, though not greatly, produced at their apices. Like in *godmani*, the apices of the wings alone are darkened, while the lateral productions of the abdominal tergites are very similar. The female sex of these species is unknown.

*Type.*—♂; Venvidio, Sinaloa, Mexico. July 28 to August 1, 1918. (J. A. Kusche.) [Hebard Collection, Type no. 866.]

Size medium, form normal for the genus. Head with juxta-ocular portions of occiput each produced dorsad in a small blunt tooth; ocelli large and approximate, forming a triangle slightly broader than deep, above which there is a fine but distinct carina, this carina forming an obtuse-angle dorsad; facial scutellum with depth about two-fifths its width, dorsal margin finely carinate and with a small, projecting tubercle on each side of the median ocellus. Pronotum of normal form for genus; surface with a few minute irregular, scattered tubercles, particularly cephalad, and with a pair of much larger tubercles just before caudal margin. Tegmina and wings fully developed, the former transparent in greater portion of discoidal and anal fields, elsewhere suffused; costal margin twice strongly convex, mesad strongly concave, distad weakly concave to the rounded produced apex, which portion is slightly longer than broad. Wings with distal portion heavily suffused, elsewhere transparent with obscure flecks; the apices briefly produced and founded. Abdomen with fourth tergite produced on each side in a large, roughly quadrate, lamellate lobe, with its distal and caudal margins irregularly serrate; fifth tergite with a smaller, but similarly specialized, triangular lobe, this tergite narrowing strongly caudad; the succeeding tergites much narrower, with lateral margins terminating caudad in a minute tubercle on each side. Supra-anal plate transverse, rounded sub-bilobate. Cerci lamellato-lobate distad, as characteristic of genus. Subgenital plate with margin transverse between the small styles. Cephalic femora lamellate dorsad, with a small triangular projection at base of this margin, which is decidedly weaker than that developed in *A. falcata* Stål. Median and caudal limbs proximad covered very thickly with very fine, elongate hairs. Median tibiae strongly narrowed mesad, then gradually thickening to apex.

Coloration that of a dead leaf, individually varying from dark vandyke brown to clay color. Spot at stigma shining, always slightly darker. Pronotum with a pair of dark brown triangular markings mesad on shaft. Transparent portions of tegmina and wings paler than elsewhere, the wings, as a result, with greater portion not darkened as in *falcata*.

The measurements (in millimeters) of the type are given first, followed by the extremes in the paratypic males. Length of body, 36, 25.4 to 39.5; length of pronotum, 10.2, 9.9 to 10.4; length of tegmen, 35.1, 32 to 35.2; greatest width of tegminal marginal field, 4.3, 4 to 4 ; length of cephalic femur, 10.9 to 10.2 mm.

It is interesting to find this tropical American genus as far north as the State of Sinaloa. Previously it was not known from north of Honduras, though Saussure records the related genus, *Pseudacanthops*, from the State of Vera Cruz, Mexico.

A series of eight paratypic males have been examined, bearing the same data as the type, except that they were taken from June 16 to August 16, 1918.

VATINAE

**Phyllovates chlorophaea** (Blanchard)

1835. *Mantis chlorophaea* Blanchard, Mag. Zool., v, Ins., p. 135. [♀; Watertown, New York (in error).]

The synonymy of this species will shortly be fully discussed. Suffice it to say, at the present time, that but a single species of *Phyllovates* is known to occur in Mexico.

Venvidio, VII, 6 to VIII, 12, 1918, 9 ♂; IX, 2, 1918, 1 small juv.

Size variation in the present series is very great, the extremes measuring as follows. Length of body, 58 to 65.5; length of frontal process, 3 to 3.3; length of pronotum, 23.3 to 29.7; length of pronotal shaft, 19.5 to 25.3; length of tegmen, 36.3 to 44.8; length of cephalic coxa, 11.1 to 14 mm.

**Vates pectinata** Saussure

1871. *Vates pectinata* Saussure, Mém. l'Hist. Nat. Mex., iv, Mantides, p. 163, pl. ii, fig. 24. [♂, Mexico?]

Venvidio, VII, 2 to 6, 1918, 2 ♂.

This magnificent and distinctive species has, since the original description, been definitely recorded from Atoyac, Vera Cruz, and Teapa, Tabasco, by Saussure and Zehntner in the Biologia, where they have splendidly figured both sexes.[44] A male from Cuernavaca, Morelos, taken at light by W. L. Tower on June 27, 1905, belonging to the American Museum of Natural History, is also before us.

[44] Pl. vi, figs. 4 and 5; pl. x, figs. 30, 31 and 32.

## Phasmidae

### HETERONEMINAE[45]

**Diapheromera erythropleura** new species (Plate VII, figures 12, 13 and 14.)

This is a very slender species, with head, however, no longer than the pronotum. In the male the pleura are bright red, the seventh tergite is half again as long as the eighth (penultimate) tergite, the cerci are unarmed proximo-internally, while the ventral margins of the median and caudal femora as well as the moderately prominent medio-longitudinal ventral carina of the latter are microscopically denticulate. In the female the color is uniform green, the seventh tergite is half again as long as the eighth, the cerci are very elongate, being almost as long as the ninth (ultimate) tergite, while the ventral margins of the median and caudal femora are not serrulate and no medio-longitudinal carina is developed ventrad.

*Type.*—♂; Venvidio, Sinaloa, Mexico. September 2, 1918. (J. A. Kusche.) [Hebard Collection, Type no. 867.]

Size medium, form very slender for the genus. Surface smooth and shining, pronotum and mesonotum with a subobsolete sulcus on each side just before the lateral margins, formed by a series of minute impressions. Seventh tergite moderately enlarged in distal two-thirds, eighth transverse, ninth (ultimate) strongly convex in dorsal portion, length subequal to width, caudal margin nearly rectangulate-emarginate with apex rounded, leaving the apex of the minute supra-anal plate exposed. Cerci unarmed, moderately elongate, curving moderately inward, with internal surface flattened and apex rounded. Subgenital opercle small, formed by eighth sternite, which is minute, weakly bilobate distad, and ninth sternite which is small, cucullate, tapering distad to the nearly acute apex, its length equal to that of the ultimate tergite. Cephalic femora slightly longer than combined length of pronotum and mesonotum. Median femora much heavier but not to the degree usual in males of the genus. Median and caudal femora with distal spine of ventro-internal margin heavy and showing a weak sigmoid tendency. Median and caudal tibiae with medio-longitudinal carina of ventral surface denticulate, this and the lateral carinae each terminating distad in a tuft of spiniform hairs.

*Allotype.*—♀; same data as type. [Hebard Collection.]

Agrees with male except as follows and as noted above. Size larger, form decidedly heavier, though much more slender than is usual in females of *Diapheromera*. Distal tergites not thickened, seventh slightly longer than

[45] This is the correct name for the subfamily termed the tribe Bacunculini by Brunner.

ninth. Cerci straight and slender. Operculum with lateral margins weakly convex-convergent distad to the acute apex, which fails to reach the median portion of the ultimate tergite, leaving the distal portion of the ovipositor valves exposed. Median femora no heavier than cephalic, median and caudal femora with distal spine of ventro-internal margin simple, straight, smaller than in male. Median and caudal tibiae with medio-longitudinal and lateral carinae of ventral surface smooth, hairy and terminated distad each in a tuft of spiniform hairs.

Coloration of male. General color prout's brown, becoming sepia on pronotum and mesonotum. Ventro-lateral portions of head, lateral portions of pronotum and of thorax only above insertion of limbs, pinkish buff. Pleura nopal red, this faintly tinging the mesonotum latero-cephalad. Caudal femora ochraceous-buff, median and caudal tibiae antimony yellow, all suffused with brown distad. Female uniform and immaculate light green.

Length of body, ♂ 78.7, ♀ 93.4; length of mesonotum, ♂ 19.2, ♀ 20.3; median width of mesonotum, ♂ 1.2, ♀ 2.8; length of metanotum (including median segment), ♂ 16, ♀ 17.2; length of median segment, ♂ 1.9, ♀ 2.1; length of first tergite, ♂ 6.5, ♀ 6.8; length of seventh tergite, ♂ 2.2, ♀ 3.2; length of eighth tergite, ♂ 1.3, ♀ 2.3; length of ninth tergite, ♂ 1.8, ♀ 2.8; length of cercus, ♂ 3.3, ♀ 2.8; length of operculum, 6.7; length of cephalic femur, ♂ 23, ♀ 24.2; length of median femur, ♂ 16.8, ♀ 17.7; length of caudal femur, ♂ 22.4, ♀ 22.8 mm.

This species is known to us only from the described pair.

PHIBALOSOMINAE

**Bostra aetolus** (Westwood)

1859. *Bacteria aetolus* Westwood, Cat. Orth. Ins. Br. Mus., I, Phasmidae, p. 27, pl. XXII, fig. 3. [♀, Mexico.]

Venvidio, VI, 16, 1918, 2 juv. ♀; VII, 6 to IX, 2, 1918, 7 ♂, 14 ♀, 1 large juv. ♂.

The present series is of great interest in that it shows the position of *aetolus* to be in *Bostra* as at present understood, the close affinity of the species to *B. jaliscensis* Rehn,[46] and demonstrates thoroughly the fact that the auricular processes of the head, lobes of the abdomen and limbs and cristation of the metatarsus, developed in the female sex, are all features subject to enormous individual variation in this and probably many other species of the group.

The following variation is noted in females of the present series. Head merely tuberculate; or with a transverse ridge of heavier tubercles on cephalic portion of occiput; or armed there

[46] It appears more than probable that the female described as *Bostra similis* by Redtenbacher, from Mexico, represents that sex of *jaliscensis*. Insektenfamilie der Phasmiden, p. 412, (1908).

with two pairs of spines, of which the outer are the longer; or with outer pair developed into roughly rounded lobes; or with these outer lobes connected with the inner spines by a jagged ridge. Abdominal tergites unspecialized; or with first and fourth with a small, flattened lamellate projection meso-caudad; or with median segment and second and third tergites with such a projection, those of the first and fourth being much larger; or with sixth tergite with latero-caudal portion lamellate and produced in narrow, horizontal lobes, rounded distad. Median femora simple; or with ventro-internal margin bearing a minute lobe or a low flange proximad and with dorso-internal margin bearing one or two very minute lobes which are usually triangular; or with ventro-internal margin bearing a rather large, foliaceous lobe which is suddenly deeply emarginate toward its caudal portion. Caudal femora usually simple, in a few specimens showing to different degrees a weak, rounded flange proximad on each ventral margin, of which that of the caudal margin is the stronger. Median and caudal tibiae simple; or bearing a small, rounded lobe on the dorso-external margin proximad. Genicular areas of median and caudal femora simple or lamellato-bilobate produced, due to a lamellation of the genicular angle and the femoral margin below. Metatarsi simple, or with those of the cephalic limbs with dorsal margin sub-lamellate, forming an obtuse-angulate outline; or with all of that type.

In all of the females the dorsal surface, except that of the abdomen, is heavily tuberculate, the mesonotum and metanotum are longitudinally tricarinate. These features, the genitalia, proportions and, to a less degree, the size, are apparently alone dependable to serve in distinguishing females of this species. Westwood described a female with an even greater complexity of lobes and lamellae, while Saussure has diagnosed a female more nearly resembling some of the present series.[47]

The male of this species agrees closely with that of *B. jaliscensis* Rehn,[48] differing as follows. Size larger, form proportionately more elongate. Seventh and eighth tergites evenly

[47] Miss. Sci. Mex., Rech. Zool., VI, p. 175, (1870).

[48] Comparison is made with the type, Acad. Nat. Sci. Phila., no. 5147.

convex, not showing weak but distinct longitudinal carinae on each side. Eighth tergite with lateral (ventral) margins very faintly convex, almost straight; not very broadly but distinctly convex. Ninth (ultimate) tergite with surface weakly convex, with a fine medio-longitudinal carina, distad rounded and subbilobate; not truncate, the distal extremity weakly bracket-shaped emarginate with latero-caudal angles deflexed, briefly produced, with apices rounded as in *jaliscensis*. Subgenital opercle deeper, surface more evenly convex, similarly produced ventro-caudad in an acute-angulate projection which is proportionately smaller but shows considerable size variation in the series.

The majority of the females are grayish, the males being darker, often brown with the sides of the head conspicuously white ventrad.

Length of body, ♂ 99 to 131.3, ♀ 142 to 187; length of mesonotum, ♂ 33 to 35.2, ♀ 35.7 to 48; length of metanotum (including median segment), ♂ 20.3 to 24.2, ♀ 27.7 to 29.9; length of median segment, ♂ 9.1 to 11.3, ♀ 10.2 to 12.8; length of cephalic femur, ♂ 33.3 to 37.3, ♀ 30.5 to 40.2; length of caudal femur, ♂ 33.1 to 38, ♀ 32.8 to 40.7; length of operculum, 24 to 29.7 mm.

## Explanation of Plates

### Plate VI

All of the specimens figured in the present paper are from Venvidio, Sinaloa, Mexico.

Fig. 1.—*Prosparatta sinaloae* new species. Male. *Type*. Dorsal view of pygidium and forceps. (× 9)

Fig. 2.—*Prosparatta sinaloae* new species. Male. *Type*. Dorsal view of pygidium. (Greatly enlarged.)

Fig. 3.—*Prosparatta sinaloae* new species. Female. *Allotype*. Dorsal view of pygidium and forceps. (× 9)

Fig. 4.—*Enthlastoblatta grata* new species. Male. *Type*. Ventral view of subgenital plate. (Much enlarged.)

Fig. 5.—*Neoblattella sinaloae* new species. Male. *Type*. Dorsal view of pronotum. (× 6½)

Fig. 6.—*Neoblattella sinaloae* new species. Male. *Type*. Ventral view of subgenital plate. (Same scale as figure 4.)

Fig. 7.—*Ischnoptera bicornuta* new species. Male. *Type*. Dorsal view of pronotum. (× 6½)

Fig. 8.—*Ischnoptera bicornuta* new species. Male. *Type.* Dorsal view of distal portion of abdomen. (Same scale as figure 4.)

Fig. 9.—*Ischnoptera bicornuta* new species. Male. *Type.* Ventral view of subgenital plate. (Same scale as figure 4.)

Fig. 10.—*Cahita nahua* (Saussure). Male. Dorsal view of distal portion of abdomen. (Much enlarged.)

Fig. 11.—*Cahita nahua* (Saussure). Male. Ventral view of subgenital plate. (Same scale as figure 10.)

Fig. 12.—*Cahita nahua* (Saussure). Male. Caudal view of distal portion of subgenital plate. (Same scale as figure 10.)

Fig. 13.—*Nyctibora tetrasticta* new species. Male. *Type.* Dorsal view. (× 2)

Fig. 14.—*Nyctibora tetrasticta* new species. Male. *Type.* Ventral view of subgenital plate. (× 3)

Fig. 15.—*Nyctibora tetrasticta* new species. Female. *Allotype.* Dorsal outline. (× 2)

## Plate VII

Fig. 1.—*Panchlora cahita* new species. Male. *Type.* Ventral view of distal portion of abdomen. (Much enlarged.)

Fig. 2.—*Holocompsa scotaca* new species. Male. *Type.* Dorsal view of pronotum. (× 8)

Fig. 3.—*Holocompsa scotaca* new species. Female. *Paratype.* Dorsal view of pronotum. (× 8)

Fig. 4.—*Holocompsa scotaca* new species. Female. *Allotype.* Dorsal view of pronotum. (× 8)

Fig. 5.—*Holocompsa scotaca* new species. Female. *Paratype.* Dorsal view of pronotum. (× 8)

Fig. 6.—*Caloblatta lampra* new species. Male. *Type.* Dorsal view of pronotum. (× 8)

Fig. 7.—*Caloblatta lampra* new species. Male. *Type.* Ventral view of subgenital plate. (Much enlarged.)

Fig. 8.—*Chorisoneura anisoura* new species. Male. *Type.* Ventral view of subgenital plate. (Much enlarged.)

Fig. 9.—*Stagmomantis colorata* new species. Male. *Type.* Dorsal view of wing. (Natural size.)

Fig. 10.—*Acanthops bidens* new species. Male. *Type.* Ventro-cephalic outline of head. (Much enlarged.)

Fig. 11.—*Acanthops bidens* new species. Male. *Type.* External lateral outline of cephalic femur. (× 2½)

Fig. 12.—*Diapheromera erythropleura* new species. Male. *Type.* Dorsal outline of cercus. (×7)

Fig. 13.—*Diapheromera erythropleura* new species. Male. *Type.* Lateral outline of distal portion of abdomen. (× 5)

Fig. 14.—*Diapheromera erythropleura* new species. Female. *Allotype.* Lateral outline of distal portion of abdomen. (× 5)

# THE BASSETT TYPES OF CYNIPIDAE (HYMENOPTERA)

BY E. T. CRESSON, JR.

In 1901 The American Entomological Society received a letter from Mr. Ezra T. Cresson, dated June 25, stating that, "Mr. H. F. Bassett, of Waterbury, Connecticut, who has for thirty years made a special study of North American galls and gall-flies, being now in poor health and unable to continue the study, desires to present his collection, with all his types, to The American Entomological Society, in trust, to be preserved and kept separate and distinct from other collections and to be known as the Homer F. Bassett Collection: a memorial of his life-work in entomology." The collection was accepted and is now one of the valued possessions of this Society. Mr. Bassett's entire collection, however, did not come to the Society, which fact is evident by the presence of some type-material in the American Museum of Natural History and other collections. This situation may be partially explained upon examining some of the correspondence between Mr. Bassett and Mr. Cresson. In a letter dated June 12, 1901, Mr. Bassett writes that he had divided his collection, "preparing some of the types for Yale and Cornell, but the full types and the main collection" for the American Entomological Society. After Mr. Bassett's death in 1902, Mrs. Bassett evidently disposed of this duplicate collection.

Mr. Bassett sent his collection to the Society in various sized card-board boxes, generally with the insects and their galls in the same box, the former in cotton. This method did not lend itself to proper care and attention; consequently, upon their receipt by the Society, the insects, or a representative part of them, were carefully mounted on points, and the galls placed in trays.

Of the one hundred and twenty-five species described by Mr. Bassett, this collection contains all but two, and these may later be found among the undetermined material. In the following list, the type specimen is understood to be in good condition unless otherwise noted.

**affinis** (Cynips), Can. Ent., XIII, 103, 1881.
10420. Connecticut? Female (tips of antennae broken). Gall.
**agrifoliae** (Cynips), Can. Ent., XIII, 53, 1881.
10540. California. Female and galls.
**ashmeadii** (Andricus), Trans. Amer. Ent. Soc., XXVI, 320, 1900.
10481. Connecticut. Female. Gall unknown.
**badius** (Amphibolips), Trans. Amer. Ent. Soc., XXVI, 323, 1900.
10473. Connecticut. Female. Gall unknown.
**bella** (Cynips), Can. Ent., XIII, 93, 1881.
10442. Tucson, Arizona. Female (antennae broken). Galls.
**californica** (Cynips), Can. Ent. XIII, 51, 1881.
10482. Redwood City, California. Female and galls.
**canescens** (Holcaspis), Trans. Amer. Ent. Soc., XVII, 66, 1890.
10458. Napa City, California. Female. Galls missing.
**capsula** (Cynips), Can Ent., XIII, 101, 1881.
10484. Connecticut? Female (antennae broken). Galls.
**carolinensis** (Amphibolips), Trans. Amer. Ent. Soc., XVII, 85, 1890.
10474. Statesville, North Carolina. Female (antennae broken). Gall
**ceropteroides** (Callirhytis), Trans. Amer. Ent. Soc., XXVI, 324, 1900.
10483. Branford, Connecticut. Female and galls.
**cicatricula** (Cynips), Can. Ent., XIII, 101, 1881. Gall only.
(Andricus), Trans. Amer. Ent. Soc., XVII, 80, 1890. Insects.
10485. Connecticut. Female and galls.
**cinerosa** (Cynips), Can. Ent., XIII, 110, 1881.
Texas. Galls and flies missing.
**clarkei** (A. (Callirhytis)), Trans. Amer. Ent. Soc., XVII, 79, 1890.
10486. Jamaica Plain, Massachusetts. Female and galls.
**clarkei** (Dryophanta), Trans. Amer. Ent. Soc., XVII, 69, 1890.
10443. Massachusetts. Female and galls.
**consimilis** (Neuroterus), Trans. Amer. Ent. Soc., XXVI, 335, 1900.
10422. Waterbury, Connecticut. Female and gall.
**corallinus** (Holcaspis), Trans. Amer. Ent. Soc., XVII, 66, 1890.
10459. Napa,City, California. Female and galls.
**corrugis** (Cynips), Can. Ent., XIII, 109, 1881.
10460. Connecticut. Female. Gall unknown.
**corrugis** (Dryophanta), Trans. Amer. Ent. Soc., XVII, 71, 1890.
10444. Connecticut. Female. Gall unknown.
**coxii** (Cynips), Can. Ent., XIII, 112, 1881.
10487. Tucson, Arizona. Female and gall.
**crystallinus** (Andricus), Trans. Amer. Ent. Soc., XXVI, 319, 1900.
10488. Napa City, California. Female and galls.
**discus** (Dryophanta), Trans. Amer. Ent. Soc., XXVI, 326, 1900.
10445. Napa City, California. Female (antenna tips broken). Galls missing.
**distortus** (Neuroterus), Trans. Amer. Ent. Soc., XXVI, 336 1900.
10423. Connecticut. Female and gall.

**dubia** (Neuroterus), Trans. Amer. Ent. Soc., xxvi, 335, 1900.
10424. Connecticut. Female. Gall unknown.
**duricoria** (Holcaspis), Trans. Amer. Ent. Soc., xvii, 64, 1890.
10461. Connecticut. Female and galls.
**eburneus** (Dryophanta), Trans. Amer. Ent. Soc., xvii, 70, 1890.
10446. Southern Utah. Female and ? galls.
**exiguissimus** (Neuroterus), Trans. Amer. Ent. Soc., xxvi, 332, 1900.
10425. Connecticut. Female and gall.
**exiguus** (Andricus), Trans. Amer. Ent. Soc., xxvi, 318, 1900.
10489. New Haven, Connecticut. Female and galls.
**exiguus** (Neuroterus), Trans. Amer. Ent. Soc., xxvi, 333, 1900.
10426. West Rock, Connecticut. Female and gall.
**fasciata** (Holcaspis), Trans. Amer. Ent. Soc., xxvi, 328, 1900.
10462. Connecticut. Female and galls.
**favosus** (Neuroterus), Trans. Amer. Ent. Soc., xvii, 87, 1890.
10427. Rockport, Ohio. Female and gall.
**ficula** (Cynips), Can. Ent., xiii, 75, 1881.
10463. Georgia. Female and galls.
**floccosa** (Cynips), Can. Ent., xiii, 111, 1881.
10428. Northern Ohio. Female and galls.
**formosa** (Cynips), Proc. Ent. Soc. Phila., iii, 679, 1864.
10490. Connecticut. Female. Galls?
**fragilis** (Neuroterus), Trans. Amer. Ent. Soc., xxvi, 335, 1900.
10429. San Diego, California. Female and gall.
**gainesi** (Amphibolips), Trans. Amer. Ent. Soc., xxvi, 322, 1900.
10475. Austin, Texas. Female and gall.
**gemula** (Cynips), Can. Ent., xiii, 104, 1881.
10447. Connecticut? Female and galls.
**gillettei** (Acraspis), Trans. Amer. Ent. Soc., xxvi, 323, 1900.
10470. Fort Collins, Colorado. Female and galls.
**gillettei** (Neuroterus), Trans. Amer. Ent. Soc., xxvi, 334, 1900.
10430. Connecticut. Female with tips of antennae broken. Galls missing.
**hirta** (Cynips), Proc. Ent. Soc. Phila., iii, 688, 1864.
10469. Connecticut. Female and galls.
**howertoni** (Andricus), Trans. Amer. Ent. Soc., xvii, 82, 1890.
10491. New Mexico. Female. Gall missing.
**howertoni** (Neuroterus), Trans. Amer. Ent. Soc., xvii, 90, 1890.
10431. New Mexico. Female (abdomen missing). Gall.
**ignota** (Cynips), Can. Ent., xiii, 106, 1881.
10448. Connecticut. Female and galls.
**ignotus** (Andricus), Trans. Amer. Ent. Soc., xxvi, 317, 1900.
10494. New Haven, Connecticut. Female. Gall unknown
**ilicifoliae** (Cynips), Proc. Ent. Soc. Phila., iii, 682, 1864.
10476. Connecticut. Female and galls.
**incertus** (Andricus), Trans. Amer. Ent. Soc., xxvi, 317, 1900.
10492. Connecticut. Female. Gall unknown.

**indistinctus** (Andricus?), Trans. Amer. Ent. Soc., XVII, 81, 1890.
10493. Northern Ohio. Female and gall.
**kingi** (Andricus), Trans. Amer. Ent. Soc., XXVI, 316, 1900.
10495. Napa City, California. Female and galls.
**leavenworthi** (Antistrophus), Trans. Amer. Ent. Soc., XXVI, 310, 1900.
10526. Petersburg, Virginia. Female and gall.
**lenticularis** (Rhodites), Trans. Amer. Ent. Soc., XVII, 59, 1890.
10536. Massachusetts. Female and galls.
**longicornis** (Amphibolips), Trans. Amer. Ent. Soc., XXVI, 321, 1900.
10477. Palestine, Texas. Male (legs missing). Gall.
**longicornis** (Dryophanta), Trans. Amer. Ent. Soc., XXVI, 327, 1900.
10449. Connecticut. Female. Gall lost by Bassett.
**macrocarpae** (Acraspis), Trans. Amer. Ent. Soc., XVII, 84, 1890.
10471. Rockport, Ohio. Female and galls.
**majalis** (Cynips), Proc. Ent. Soc. Phila., III, 683, 1864.
10432. Connecticut. Female (antennae tips broken). Gall.
**mammula** (Cynips), Can. Ent., XIII, 76, 1881.
10467. Connecticut. Female and galls.
**maxwelli** (Andricus), Trans. Amer. Ent. Soc., XVII, 83, 1890.
10496. Palestine, Texas. Female and galls.
**mexicanus** (Andricus?), Trans. Amer. Ent. Soc., XVII, 78, 1890.
Mountain near Guadalajara, Mexico. Insect unknown. Only woolly covering of galls. No actual galls.
**minuta** (Cynips), Can. Ent., XIII, 96, 1881.
10433. Connecticut. Female and gall.
**minimus** (Diastrophus), Trans. Amer. Ent. Soc., XXVI, 325, 1900.
10527. Connecticut. Female and gall.
**nebulosus** (Rhodites), Trans. Amer. Ent. Soc., XVII, 63, 1890.
10537. Connecticut? Male and galls.
**niger** (Diastrophus), Trans. Amer. Ent. Soc., XXVI, 324, 1900.
10528. Woods Hole, Massachusetts. Female and galls.
**noxiosa** (Cynips), Can. Ent., XIII, 108, 1881.
10434. Connecticut. Female and galls.
**nubila** (Cynips), Can. Ent., XIII, 56, 1881.
10450. Mule Pass Mountains, Arizona. Female and galls.
**obtusilobae** (Andricus), Trans. Amer. Ent. Soc., XXVI, 316, 1900.
10497. Connecticut. Female. Gall unknown.
**operatola** (Andricus), Trans. Amer. Ent. Soc., XXVI, 315, 1900.
10498. Waterbury, Connecticut. Female and galls.
**osten-sackenii** (Cynips), Proc. Ent. Soc. Phila., II, 327, 1863.
10499. Connecticut? Female and galls.
**pallidus** (Neuroterus), Trans. Amer. Ent. Soc., XVII, 88, 1890.
10435. Connecticut. Female and galls.
**pallipes** (Dryophanta), Trans. Amer. Ent. Soc., XXVI, 327, 1900.
10152. Waterbury, Connecticut. Female (antennae and tarsi broken). Galls.

**pallipes** (Neuroterus), Trans. Amer. Ent. Soc., XVII, 89, 1890.
10421. Jamaica Plain, Massachusetts. Female (antennae broken). Galls.
**palmeri** (Amphibolips), Trans. Amer. Ent. Soc., XVII, 86, 1890.
10478. Chihuahua, Mexico. Female (tarsi broken). Gall.
**papula** (Cynips), Can. Ent., XIII, 107, 1881.
10451. Connecticut. Female and galls.
**parmula** (Andricus), Trans. Amer. Ent. Soc., XXVI, 312, 1900.
10500. Napa City, California. Female and galls.
**parvula** (Dryophanta), Trans. Amer. Ent. Soc. XXVI, 326, 1900.
10453. Connecticut. Female. Gall unknown.
**patiens** (Andricus). Trans. Amer. Ent. Soc., XXVI, 312, 1900.
10501. Connecticut. Female. Gall unknown.
**pattoni** (Cynips), Can. Ent., XIII, 98, 1881.
10502. New Haven, Connecticut. Female and galls.
**pedunculata** (Dryophanta), Trans. Amer. Ent. Soc., XVII, 72, 1890.
10454. Connecticut. Female and galls.
**perditor** (Andricus), Trans. Amer. Ent. Soc., XXVI, 313, 1900.
10503. Connecticut. Female and galls.
**perminimus** (Neuroterus), Trans. Amer. Ent. Soc., XXVI, 332, 1900.
10436. Rockport, Ohio. Female and galls.
**perniciosus** (Holcaspis), Trans. Amer. Ent. Soc., XVII, 68, 1890.
10464. Southern Utah. Female and galls.
**petiolicola** (Cynips), Proc. Ent. Soc. Phila., II, 325, 1863.
10504. Waterbury, Connecticut. Female. Galls missing.
**pigra** (Cynips), Can. Ent., XIII, 105, 1881.
10505. Connecticut. Female and galls.
**pilula** (Andricus), Trans. Amer. Ent. Soc., XVII, 77, 1890.
10506. Utah. Female and galls.
**piperoides** (Andricus), Trans. Amer. Ent. Soc., XXVI, 314, 1900.
10507. Connecticut. Female and galls.
**podagrae** (Aulax), Trans. Amer. Ent. Soc., XVII, 91, 1890.
10534. Connecticut. Female and galls.
**polita** (Cynips), Can. Ent., XIII, 99, 1881.
10455. Philadelphia, Pennsylvania. Female and galls.
**politus** (Acraspis), Trans. Amer. Ent. Soc., XVII, 85, 1890.
10472. Washington County, Missouri. Female. Gall unknown.
**politus** (Neuroterus), Trans. Amer. Ent. Soc., XVII, 89, 1890.
10437. Southern Utah. Male (antennae missing). Gall.
**pomiformis** (Cynips), Can. Ent., XIII, 74, 1881.
10508. California. Female and galls.
**potentillae** (Diastrophus), Proc. Ent. Soc. Phila., III, 689, 1863.
10529. Connecticut. Female and galls.
**pruinosus** (Andricus), Trans. Amer. Ent. Soc., XXVI, 311, 1900.
10509. New Haven, Connecticut. Female and galls.
**pulchellus** (Andricus), Trans. Amer. Ent. Soc., XXVI, 314, 1900.
10510. Connecticut. Female (antennae broken). Gall unknown.

**pulchra** (Andricus), Trans. Amer. Ent. Soc., XVII, 73, 1890.
10511. Connecticut. Female and galls.
**pumiliventris** (Dryophanta), Trans. Amer. Ent. Soc., XVII, 69, 1890.
10456. Connecticut? Male. Galls missing.
**punctata** (Cynips), Proc. Ent. Soc. Phila., II, 324, 1863.
10512. Waterbury, Connecticut. Female and galls.
**pusulatoides** (Andricus), Trans. Amer. Ent. Soc., XVII, 74, 1890.
10513. Connecticut. Female and gall.
**radicis** (Callirhytis), Psyche, V, 237, 1889.
10541. Connecticut. Female and galls.
**radicum** (Diastrophus), Can. Ent., II, 98, 1870.
10530. Connecticut. Female and galls.
**reticulata** (Andricus), Trans. Amer. Ent. Soc., XVII, 74, 1890.
10514. New Mexico. Female cut from gall. Bassett's note on box "Insects lost." Galls.
**rileyi** (Cynips), Amer. Nat., XV, 149, 1881.
10438. North Bend, Ohio. Female and galls.
**ruginosus** (Andricus), Trans. Amer. Ent. Soc., XVII, 75, 1890.
10515. New Mexico. Female. Galls lost by Bassett.
**rugosa** (Cynips), Can. Ent., XIII, 100, 1881.
10465. Connecticut. Female and galls.
**saccularius** (Andricus), Trans. Amer. Ent. Soc., XVII, 76, 1890.
10516. Connecticut. Male (tips of antennae broken). Galls.
**scitula** (Cynips), Proc. Ent. Soc. Phila., III, 683, 1864.
10517. Connecticut. Female and galls.
**sculptus** (Cynips), Proc. Ent. Soc. Phila., II, 324, 1863.
10479. Connecticut. Female and galls.
**seminosus** (Andricus), Trans. Amer. Ent. Soc., XVII, 76, 1890.
10518. Rockport, Ohio. Female and galls.
**sileri** (Holcaspis), Trans. Amer. Ent. Soc., XVII, 67, 1890.
10466. Utah. Female (wings and dorsal portions of head and thorax missing). Galls.
**similis** (Cynips), Proc. Ent. Soc. Phila., III, 685, 1864.
10519. Connecticut. Female and galls.
**similis** (Diastrophus), Can. Ent., XIII, 95, 1881.
10532. Connecticut. Female and galls.
**similis** (Dryophanta), Trans. Amer. Ent. Soc., XVII, 71, 1890.
10457. Southern Utah. Female. Galls missing or confused with those of *D. cburneus*.
**singularis** (Cynips), Proc. Ent. Soc. Phila., II, 326, 1863.
10520. Connecticut. Female and galls.
**speciosus** (Andricus), Trans. Amer. Ent. Soc., XVII, 81, 1890.
10521. Napa City, California. Female and galls.
**spicatus** (Loxaulus), Trans. Amer. Ent. Soc., XXVI, 329, 1900.
10468. Arizona. Female and galls.
**suttonii** (Cynips), Can. Ent., XIII, 54, 1881.
10522. California. Female and galls.

**tectus** (Neuroterus), Trans. Amer. Ent. Soc., XXVI, 331, 1900.
10439. Waterbury, Connecticut. Female and galls.
**tenuicornis** (Cynips), Can. Ent., XIII, 92, 1881.
10533. Mule Pass Mountains, Arizona. Female and galls.
**tuberosa** (Andricus), Trans. Amer. Ent. Soc., XXVI, 311, 1900.
10523. Waterbury, Connecticut. Male. (Weld says female is not conspecific [antennae missing beyond second joint].) Galls.
**tumidus** (Aulax), Trans. Amer. Ent. Soc., XVII, 92, 1890.
10535. Connecticut. Female and gall.
**tumidus** (Rhodites), Trans. Amer. Ent. Soc., XVII, 60, 1890.
10538. Utah. Male (antennae broken). Gall.
**turgidus** (*turgigus* lapsus calami) (Diastrophus), Can. Ent., II, 99, 1870.
10531. Connecticut. Female and galls.
**umbilicatus** (Neuroterus), Trans. Amer. Ent. Soc., XXVI, 330, 1900.
10440. Connecticut. Female and galls.
**utahensis** (Rhodites), Trans. Amer. Ent. Soc., XVII, 62, 1890.
Utah. Insects and galls missing.
**utricula** (Cynips), Can. Ent., XIII, 78, 1881.
10524. Connecticut. Female (tips of antennae broken). Galls.
**variabilis** (Rhodites), Trans. Amer. Ent. Soc., XVII, 61, 1890.
10539. Utah. Female (hind tarsi broken). Galls.
**ventricosa** (Cynips), Proc. Ent. Soc. Phila., III, 681, 1864.
10525. Connecticut. Female and galls.
**verna** (Amphibolips), Trans. Amer. Ent. Soc., XXVI, 321, 1900.
10480. Waterbury, Connecticut, Female. Gall unknown.
**vesicula** (Cynips), Can. Ent., XIII, 97, 1881.
10441. Connecticut. Female and galls.

# A NEW SPECIES OF HESPERIIDAE

## (LEPIDOPTERA, RHOPALOCERA)

BY E. L. BELL

While collecting in Florida during March 1921, a number of Hesperiid butterflies superficially resembling *Cocceius pylades* Scudder, were captured. There are, however, several points in which they differ from that species, principally in that the males have no costal fold, the palpi are grayish and not concolorous with the body, and the genitalia are different. The lack of costal fold in the male and the lighter colored palpi more nearly resemble *Thorybes daunus* Cramer, but the shape of the wings is quite different from that species, the primaries being not so pointed at the apex and the secondaries not so produced anally, but more rounded; the maculation of the upper surface of the primaries is usually much reduced, especially in the male, and genitalia are different. For this species, from the probability of its having been long confused with the two species mentioned, I propose the name of

**Thorybes confusis** new species

1922. *Cogia* (*Thorybes*) species Skinner and Williams, Trans. Amer. Ent. Soc., XLVIII, p. 124, fig. 29 (genitalia).

Size—male, 31 mm. to 37 mm.; female 31 mm. to 40 mm.

♂. *Upperside: primaries*, dark brown with a band of irregularly shaped white spots extending in an oblique line from about the center of the costa toward the inner angle; usually composed of two small spots between the costa and the cell, and one just inside the cell, a small spot below, placed out of line toward the outer margin, then a longer, narrow spot below and in a line with the three small spots near the costa; below this a small spot placed a little out of line toward the outer margin. There are four, small, subapical, white spots, the first three placed in a line and the fourth and lowest slightly out of line toward the outer margin. The spots composing the band are frequently greatly reduced, and sometimes entirely lacking; the subapical spots reduced to mere traces. Fringes dark except at the inner angle where they are a lighter color; there is a narrow line of darker scales across the fringe at the end of each vein.

*Secondaries:* dark brown and immaculate; fringes lighter, about the same color as the light spot at the inner angle of the primaries, with the dark scales at the ends of the veins, as in the primaries.

*Underside: primaries,* brown, sometimes with hoary area along the outer margin especially pronounced at the apex, and a light colored band along the inner margin; the spots of the upper side are repeated.

*Secondaries:* brown, sprinkled with white scales; darker on the basal area. Across the basal third of the wing there is an irregular dark band, and another similar band about midway between this band and the outer margin. The lighter colored area between the outer band and the margin is sometimes hoary.

♀. Same as the male except that the wings are slightly more rounded, and the spots of the primaries are a little larger; the spot just inside the cell is sometimes elongated, extending across the cell.

Palpi grayish and no costal fold in the male.

Described from 55 males and 19 females collected at Tampa, Florida. Male and female types and two paratypes in American Museum of Natural History, New York City; two paratypes in National Museum, Washington, D. C.; two paratypes in Brooklyn Museum, Brooklyn, N. Y., and remaining paratypes in collection of E. L. Bell. I have tentatively placed this species in the genus *Thorybes* on its general resemblance to the other species in that genus, but it may possibly not belong there.

Sometimes females of this species are not readily separated from the females of *Thorybes daunus;* on the upper surface, though, there is usually a slight difference in the arrangement of the spots. In such cases, however, the color and general appearance of the secondaries below is quite sufficient to separate them in all the specimens I have seen. I also have this species from Missouri and Arkansas.

# THE GENITALIA OF MALE DIPTERA AND MECOPTERA COMPARED WITH THOSE OF RELATED INSECTS, FROM THE STANDPOINT OF PHYLOGENY

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For identifications and material of Diptera, I am deeply indebted to Dr. C. P. Alexander, Dr. J. M. Aldrich, and Dr. C. W. Johnson, and I am likewise deeply indebted to Dr. Bethune-Baker for the loan of a specimen of *Micropteryx* (*Eriocephala*) *calthella*, and to Dr. P. A. Buxton, for a fine series of *Micropteryx* (*Eriocephala*) *sepella*.

There have been published a number of papers dealing with the genitalia of male Diptera, such as the fine paper by Metcalf on the Syrphidae, Snodgrass on the Tipulidae, Edwards on the Culicidae, etc., and several investigators such as Berlese, Crampton, Newell, Wesché, and others have compared the parts of the genitalia of male Diptera with those of lower insects. In most cases, however, no attempt has been made to trace the origin of the modifications met with in the Diptera through a series of intermediate forms to a basic plan common to all insects, and until this is done, we cannot arrive at a correct interpretation of the parts in the Diptera and related forms. I would therefore use as the basis of the following discussion, the fundamental plan of the genitalia of male insects in general, described in the Canadian Entomologist,[1] and I would trace the modifications of this fundamental plan through the Hymenoptera and Mecoptera (which furnish the intermediate types, connecting the Diptera with the lower forms) to the dipteran types, giving consideration to the conditions met with in certain Hemiptera, Lepidoptera, Trichoptera, etc., when the condition exhibited by these forms has a bearing upon the interpretation of the parts in the Diptera.

[1] LII, 1920, p 180—see also correction on page 72 of LIII, 1921.

The principal features of the genitalia of male insects are the intromittent organ or aedeagus, and the claspers or genital styles (gonostyli), both of which are apparently structures borne on the sternal region of the ninth abdominal segment. In male Ephemerida, the gonostyli or genital styles, labeled *ex* in figures 1 and 4, are borne on a basal plate labeled *p*, while the intromittent organ is made up of a pair of penisvalvae, labeled *en*. As was pointed out in the article referred to above, the basal plates *p* of figure 4, may possibly represent the protopodites of a pair of biramous Crustacean limbs, while the genital styles *ex* may represent the exopodites of such a pair of biramous limbs, and the penis valves *en* may possibly correspond to the endopodites of the crustacean limbs. In insects, it is usually the modified limbs and processes of the ninth abdominal segment which make up the genitalia of the male, and unless this fact is clearly understood, confusion is likely to ensue, since parts of the ninth abdominal segment may be mistaken for the tenth segment, as is the case in the investigations of Berlese, Metcalf, and others.

In certain ephemerids, the protopodites (coxites) or basal segments of the modified abdominal limbs of the ninth segment, are distinct, and in the ephemerid shown in figure 4, they are represented as partially distinct (i.e. the structures labeled *p* in figure 4), while in other ephemerids they unite to form a single basal plate (syncoxite), which is borne in the posterior region of the ninth abdominal sternite, and resembles a tenth abdominal sternite so closely that unless one knows its developmental history, he would mistake it for the tenth abdominal sternite. When the protopodites of the limbs of the ninth abdominal segment are distinct, as in certain Lepismatidae and similar forms, they are called coxites. In male sawflies, as for example in the one shown in figure 5, the basal plate labeled *sp*, which represents the united coxites or protopodites labeled *p* in figure 4, (i.e. it is a "syncoxite") is called the gonocardo. The genital styles *ex* of the sawfly shown in figure 5 represent the genital styles (gonostyli) or modified exopodites labeled *ex* in the ephemerid shown in figure 4, while the penisvalvae *pv* of figure 5 probably represent the modified endopodites or the penis valves *en* of figure 4. The genital styles *ex* of the ephemerids and saw-

flies (figures 4 and 5) are sometimes called gonopods, but the term gonopod should refer to the entire modified abdominal limb (i.e. it should include the basal segment *p* of figure 4, as well as the genital style *ex*, etc.).

As was described above, the principal parts of the genitalia of sawflies may be readily compared with those of male ephemerids, and since the sawflies have retained the primitive condition in many respects, they serve to connect the higher insects with the lower ones. Within the sawfly group the following modifications of the general plan shown in figure 5, may take place. The basal plate *sp* of figure 5 frequently becomes reduced to a narrow ring, such as the one labeled *sp* in figures 3 and 8, and this basal plate is either atrophied, or it is greatly reduced and may unite with the basal segment of the genital styles in higher insects.

In the following comparison of the parts of sawflies with higher insects, I shall have occasion to refer to parts which were originally dorsal in certain of these forms, but have become secondarily ventral through a torsion or revolution of the parts about their long axis (through one hundred and eighty degrees). The object of this revolution through one hundred and eighty degrees is to facilitate mating (see figure 24), and takes place in the male alone, so far as I am aware, I have found such a revolution of the parts in certain male sawflies, and a number of Diptera (and I strongly suspect that a similar condition occurs in the Embiidae, although I cannot prove this as yet). Unless one realizes what has happened in such cases, he is misled into attempting to homologize parts which were originally dorsal and have become ventral only secondarily (through a revolution of the parts about their long axis through one hundred and eighty degrees), with parts which were always ventral and have remained so—an error made by Newell, 1918, in the sawflies, and by Brolemann, 1919, in culicid Diptera, etc. I would therefore emphasize the fact that in comparing the sawflies here discussed, with certain of the Diptera, the terms primitively dorsal and primitively ventral as applied to the sawflies, etc., refer to the original position of the parts in question, which have become

secondarily ventral by being twisted around their long axis (they revolve as a whole, not singly). In primitive sawflies the parts remain in their normal position, and thus enable us to determine the original relations of the parts, and to homologize them with other insects. Bearing these facts in mind, I would call attention to the following modifications of the parts in male sawflies, which throw considerable light upon the interpretation of the genital structures of the Diptera and other higher insects.

In some sawflies, median portions of the basal segments of the genital styles become detached from their respective segments and approaching one another, unite to form a median interbasal plate (interbasis or connective) or median plate primitively situated above the penis valves (intromittent organs), although in some sawflies, the plate in question appears to be below the penis valves, since a secondary torsion of the parts causes the plate to lie below the penis valves when the genital apparatus turns over (through one hundred and eighty degrees). In the sawfly shown in figure 3, the connective or interbasal plates, labeled *ib*, are partially detached from their respective basal segments *gs*, and tend to unite in the median line of the genitalia —a process which is completed in certain sawflies. In the Dipteron shown in figure 7, there occurs immediately above the intromittent organ *ae*, an apron-like plate *ib* which is connected laterally with the bases of the genital styles *gs*, and from its position above the intromittent organ and between the bases of the gonostyli it apparently represents the united interbasal plates *ib* of the sawfly shown in figure 3 (albeit, in the sawfly in question, these plates have secondarily come to lie below the intromittent organ, as in the higher sawflies—but not in the lower ones). On the originally ventral (but secondarily dorsal) surface of the genitalia of the sawfly shown in figure 8, two slender structures labeled *vv* (which may possibly represent the so-called volsellae of higher Hymenoptera) become detached from the median portions of the basal segments of the genital styles *gs*. The small genital ossicles labeled *s* in the sawfly shown in figure 8 (which may possibly represent the so-called sagittae of higher Hymenoptera), are also apparently detached portions of the basal segments of the genital styles *gs*, which

migrate to a position on either side of the intromittent organ *pv* (or they may be simply outgrowths on either side of the intromittent organ), and the above-mentioned structures may become involved in the formation of the intromittent organ of higher insects. In some cases, I think that secondary chitinizations of the body wall in the neighborhood of the opening of the ejaculatory duct enter into the composition of the intromittent organ, and the various secondarily formed portions of the intromittent organ make it very difficult to interpret the parts correctly in certain cases, unless all of the evolutionary stages in their formation can be found. In some insects, the terminal portion of the ejaculatory duct forms the penis, but it is preferable to speak of the intromittent organ simply as the aedeagus, regardless of the homologies of its various parts.

If we compare the claspers of the sawfly shown in figure 5, with those of the ephemerid shown in figure 4, it would appear much more probable that the basal segments of the claspers *gs* of the sawfly shown in figure 5 represent the basal segments of the genital styles *gs* of the mayfly shown in figure 4, rather than that the basal segments *gs* of the claspers of the sawfly shown in figure 5 should represent the coxites or protopodites *p* of the ephemerid shown in figure 4 (since the basal plate *p* of figure 5 represents the united coxites *p* of figure 4), and the musculature of the parts in question would permit of such an interpretation. The two-segmented genital claspers or genital styles *ex* of the sawfly shown in figure 8 are apparently homologous with the two-segmented genital styles *ex* of the mecopteron shown in figure 25, as I have pointed out in several papers dealing with these insects; so that Muir, 1921, is evidently mistaken in attempting to homologize the basal segment *gs* of the two-segmented genital style *ex* of figure 25, with the coxites or protopodites *p* of figure 4, instead of homologizing the basal segments *gs* of the two-segmented genital styles *ex* of figure 25 with the basal segments *gs* of the two-segmented genital styles *ex* of figure 4, as should be done. This is a very important matter, since the proper interpretation of the claspers of the Diptera depends upon the correct interpretation of the parts in the Mecoptera, which approach the dipteran type remarkable closely.

Having determined that the basal segment of the two-segmented genital style *gs* of the mecopteron shown in figure 25 is in all probability the basal segment of the two-segmented gonostylus *ex* of figure 4 (rather than the homologue of the coxite *p* of figure 4), it naturally follows that the structure labeled *gs* in the mecopteron shown in figure 6 (which is in every way homologous with the basal segment *gs* of the two-segmented genital style of the mecopteron shown in figure 25), likewise represents the basal segment *gs* of the gonostyle *ex* of the ephemerid shown in figure 4, and it is a very simple matter to compare the parts of the claspers of the mecopteron shown in figure 6, with those of the dipteron shown in figure 9. Thus, the eighth abdominal tergite $8^t$ of figure 6 is homologous with the eighth tergite $8^t$ of figure 9, and the ninth tergite $9^t$ of figure 6 is homologous with the ninth tergite $9^t$ of figure 9, while the basal segments of the gonostyli *gs*, which are located on either side of the ninth tergite $9^t$ in figure 6, very evidently correspond in every way to the basal segments *gs* of the gonostyli, which are also located on either side of the ninth tergite $9^t$ in figure 9, and the second segments *h* of the gonostyli bear very similar median processes in both insects.

A study of the lower insects would suggest that the two-segmented genital styles *ex* of figures 4, 5, etc., are modified exopodites of the limbs of the ninth abdominal segment, so that if this be correct, it is easily seen that the two-segmented genital styles *ex* of figures 25 and 26 are also merely modified exopodites of the limbs of the ninth abdominal segment, and consequently the two-segmented genital styles *ex* of figure 9 (which correspond in every way to the structures bearing the same labels in figure 6) are possibly merely the modified exopodites of the limbs of the ninth abdominal segment. Berlese confuses the basal segments *gs* of the gonostyles *ex* of the ninth segment with the tenth sternite (and even with the parapodial plates of Dermaptera, etc.), and Newell has gotten the interpretation of the parts into such a snarl in the Diptera and Hymenoptera that it is hopeless to try to find out what is really intended in her drawings, though I suspect, from her figures of the Mecoptera, that she would interpret the basal segments of the genital styles as the ninth

abdominal sternite. Metcalf apparently regards the basal segments of the genital styles of the ninth abdominal segment as the sternite of the tenth segment, and consequently interprets the second (terminal) segment of the genital styles as the appendages of the tenth abdominal segment. This very confusing mix-up will undoubtedly throw anyone not conversant with the true state of affairs completely off the track, and the confusion is by no means lessened by the fact that Snodgrass (who is usually one of the most careful and dependable of investigators) has promulgated the idea that the basal segment of the genital styles of Diptera represent the pleural plates of the ninth segment. Their origin in lower insects very clearly shows that the styli are originally ventral structures borne on the sternite of the ninth segment, and a comparison of the basal segments *gs* of the genital styles of the Mecoptera shown in figures 31 and 34, with the basal segments *gs* of the genital styles of the Dipteron shown in figure 32, clearly indicates the process by which the basal segments *gs* of the genital styles, which are ventral in lower insects (figure 4), may become secondarily crowded into the lateral region of the segment as in figure 32 (*gs*), since in figure 34, the basal segment *gs* is somewhat lateral in position, while in figure 31 it becomes pronouncedly so, and thus anticipates the condition exhibited by the dipteron shown in figure 32.

It is a very difficult problem to decide what terms to apply to the basal and distal segments of the genital styles of the ninth abdominal segment. The basal segment *gs* of figure 8 has been called the gonostipes in male sawflies, and the distal segment has been variously termed the cochliarium, harpes, parameres, etc., in these insects. The designation harpes and harpagones has also been variously applied by lepidopterists to the fused segments of the entire genital styles (or to various other parts as well), and the dipterists have further complicated the confusion by applying these terms to still other structures, so that it is impossible to apply these terms in the orders in question without creating confusion. While I prefer the designation gonostipes for the basal segment *gs* of the genital styles, and the designation harpes or parameres for the distal segment *h* of the

genital styles, it is preferable to designate the basal and distal segments of these styles simply as the basistylus and dististylus respectively, (until the matter is finally settled) if we are to avoid confusion. The latter designations are descriptive and also indicate the probable nature of the structures in question, so that it has seemed preferable to adopt them in the present discussion.

In the dipteron shown in figure 7, the basistyle *gs* (basal segment of the genital style) has remained in the condition typical of the basal segment of the style in the lower forms, but the dististyle *h* (distal segment of the genital style) becomes differentiated into an apical appendage *a* (the apicappendix) and a subapical appendage *sa* (subappendix). In the dipteron shown in figure 36, the apical appendix *a* has become detached from the subapical appendix *sa*, and the process has been carried still further in other forms. The apical appendix *a* of figure 7 apparently represents the apical portion *a* of the distal segment of the genital style of the insects shown in figures 6 and 9, while the subapical appendage *sa* of figure 7 apparently corresponds to the subapical process *sa* of the distal segment of the genital style of the insects shown in figures 6 and 9, and it is only by comparing the parts in the Diptera and related Mecoptera, that we are able to reach an approximately correct interpretation of these parts in the higher forms.

In the dipteron shown in figures 10 and 12, the basistyle *gs* (basal segment of the genital style) becomes bent inward, and the inflexion of the segment partially divides it into two secondarily-formed subdivisions or pseudosegments, and in the dipteron shown in figure 12, all that is left of the true distal segment (dististyle) of the genital style is represented by the apical and subapical appendages. In the dipteron shown in figure 11, the basal and distal segments of the genital styles are greatly modified, the basal segment being represented by the plate labelled *gs*, while the distal segment *h* has developed various outgrowths and other modifications which tend to mask its true character as a distal segment of the genital style. In the syrphid shown in figure 22, the distal segment *h* of the genital style is flat and broad, while the basal segment *gs* is more membranous, and becomes quite closely applied to the pleural region of the ninth abdominal segment.

In the mecopteron shown in figure 25, the ninth tergite bearing the label $9^t$, bears two lobe-like processes, the surstyli or surgonopods, *sg*, which are situated above the gonopods or modified genital limbs (genital styles), and in the mecopteron shown in figure 26, the surgonopods or copulatory lobes *sg* are modified to form accessory claspers in mating. In the dipteron shown in figure 32, the surgonopods *sg* also serve as accessory clasping organs, while in the dipteron shown in figure 37 the surgonopods *sg* are broad backward-projecting lobes which appear as though they might also be used as secondary claspers in mating. In the dipteron shown in figure 35, the homologues of the surgonopods *sg* are not very large, nor are they well developed in the mecopteron shown in figure 33 (*sg*). In the Lepidoptera shown in figures 16 and 19, the surgonopods *sg* are fairly large, and, as in the trichopteron shown in figure 15, the surgonopods *sg* usually occur on either side of a median backward prolongation of the ninth tergite called the tegumen in Lepidoptera (i.e. *tm* of figures 19, 16, and 15). The backward-projecting portion of the ninth tergite labeled *tm* in the mecopteron shown in figure 20, is also apparently homologous with the tegumen *tm* of the Lepidoptera and Trichoptera (figures 16 and 15), and since this structure occurs in the Lepidoptera, Trichoptera and Mecoptera, which are very closely related to the Diptera, it is indeed surprising that few if any Diptera have developed a tegumen.

In the hemipteron shown in figure 14, the ninth sternite bears a pair of valves, *hv*, called the hypovalvae, which are backward-projecting processes of the sternite. In the mecopteron shown in figure 17, the hypovalvae *hv* are short, but in the mecopteron shown in figure 13, the hypovalvae *hv* are long slender processes, and the character of these valves should be of value in classification, since they are typical of the species in question. The backward-projecting processes *hv* of the ninth sternite of the dipteron shown in figure 11, are probably homologous with the hypovalvae of the other insects referred to above.

From its position beneath the male genital apparatus, the sternum of the ninth abdominal segment *ha* of figures 32, 34, 20, 17, etc., has been called the hypandrium, or subgenital plate of the male, and it is this plate which bears the true hypovalvae or subgenital valves, mentioned above, when these are present.

The sternite of the eighth abdominal segment may also be prolonged backward to form a pseudohypandrium, such as the one labeled $8^s$ in figure 37. In the dipteron shown in figure 11, the eighth sternite $8^s$, which forms a pseudohypandrium or pseudo-subgenital valve of the male, also bears a pair of pseudostyli, *ps*, suggestive of the valves borne on the ninth sternite (hypovalvae) or true subgenital plate of the male. The epandrium or ninth tergite situated above the genital apparatus of the male, which bears the label *ea* in figures 27, 33, 9, 6, etc., is frequently characteristic of the different insects in size, contour, etc., and may offer a character of value in classification, since it (like the hypandrium) is readily seen without dissecting out the parts, as is usually necessary in studying the genitalia themselves.

Behind the ninth abdominal segment, there occurs in many insects an anus-bearing structure called the proctiger (*pg* of figures 6, 7, 10, 12, 14, 18, 20, 24, 25, 26, 29, 33, 35, 37 and 38), which possibly represents the united tenth and eleventh abdominal segments, since in the mecopteron shown in figure 20, and in the dipteron shown in figure 35, it bears the cerci *c*, which are supposedly appendages of the eleventh abdominal segment. At least, embryologists such as Heymons, Wheeler, and others claim that the cerci are modified limbs of the eleventh abdominal segment, and if the cerci arise as the limbs of the eleventh segment in the embryo, there is no gainsaying the fact that they belong to the eleventh segment, and the proctiger *pg* of figures 20, 35, etc., must therefore contain the eleventh segment in its composition (as well as the tenth). I am not entirely convinced that the cerci are really the limbs of the eleventh rather than of the tenth abdominal segment, however, since it appears to me that the basal segment (protopodite, or parapodial plate) of the modified limb, whose endopodite forms the cercus, has been mistaken for the eleventh sternite by the embryologists, as I have pointed out in a paper published in Entomological News,[2] and it is quite possible that the cerci are the modified limbs of the tenth instead of the eleventh abdominal segment, as they appear to be in other insects which I have examined from the

[2] XXII, p. 257.

standpoint of comparative morphology. Metcalf interprets the plates labeled *c*, which are situated on either side of the anus in the syrphid shown in figures 23 and 22, as the cerci. I am more inclined to regard these structures as the representatives of the basal plates *pp* or paraprocts (parapodial plates, or protopodites), which are situated on either side of the anus and bear the cerci labeled *c* in the female dipteron shown in figure 21. Such parapodial plates bearing the true cerci are also present in the mecopteron shown in figure 18, and in these insects the plates in question are broad flattened plates, rather than the typical cylindrical structures forming the cerci *c* of the dipteron shown in figure 35, for example (or the cerci labeled *c* in the mecopteron shown in figure 17). I have provisionally adopted the interpretation of the plates labeled *c* in figures 9, 22, 23, etc., as the cerci, however, since I cannot prove that they are the parapodial plates (paraprocts) rather than the cerci, and Metcalf and Berlese may be right in calling them cerci, though I feel that this matter should be investigated from the embryological standpoint before it is regarded as definitely settled.

As was mentioned above, the abdominal segments which bear the anus are called the proctiger (*pg* of figures 33, 35, 38, etc.). The ninth abdominal segment of the male, being the genital segment par excellence, might be referred to as the gonomere (the term andromere has also been proposed for it). Its tergite is here referred to as the epandrium, and its sternite as the hypandrium. Its pleurite (also called the gonopleurite) may be referred to as the parandrium. These terms are much less cumbersome than such designations as the "ninth abdominal tergite of the male" (epandrium), the "ninth abdominal sternite of the male" (hypandrium) etc., and are proposed merely for the sake of convenience and brevity. Since the terms ovipositor, terebra, etc., are already in use for the external genital apparatus of the female, the term genitalia may readily be restricted to the accessory genital apparatus of the male, and is, in fact, so used by a great number of investigators in the different orders of insects. It would be preferable to apply the term "genitalia" to the claspers and adeagus alone, but there is no objection to including the accessory claspers (surgonopods) formed by the

outgrowths of the ninth tergite, or the pseudo-styli *ps* of the insect shown in figure 11, under the designation "genitalia," as well.

Metcalf, 1921, divides the abdomen of the Syrphidae (sensu lato) into a preabdomen and a postabdomen; the preabdomen includes the segments which are not greatly modified (i. e. it includes segment four of figure 23), while the postabdomen includes the reduced and modified segments (i.e. segments five to ten inclusive, in figure 23) which are usually contorted or twisted about in a peculiar fashion in adaptation to the method of mating of these Diptera. The designations preabdomen and postabdomen are very convenient ones in syrphid morphology, but are not applicable in most other insects, althought the slender terminal segments of certain Mecoptera might readily be distinguished as the "postabdomen." The peculiar twisting of the terminal segments of male syrphids has already been referred to. The condition met with in the syrphids, however, is quite different from the torsion of the terminal segments (usually the ninth—or eighth also—and the anus-bearing segments) in male culicids, certain mycetophilids, etc. Unlike the torsion of the genitalia of male sawflies, the anus-bearing segments are also involved in the revolution of the genitalia of the Diptera. As shown in figure 24, this revolution of the parts of the male would facilitate the insertion of the intromittent organ *ae* into the opening of ninth segment of the female. I have not been able to observe the copulation of many Diptera in order to determine what parts of the female have become adapted to the reception of the genitalia of the male insect; but in the female mycetophilid shown in figure 21, the styloreceptor, or plate labeled *sr*, apparently is developed to receive the genital styles *h* of the male shown in figure 24, although in many cases in these insects, the claspers of the male slip backward and pinch the sternite of the eighth segment with such force that it is surprising that the female is not hurt by the pressure, the claspers being so tensely pressed together that even plunging a copulating pair into alcohol does not cause the male to loosen his grasp in most instances.

Only the more important parts of the genitalia have been described and homologized in the present paper, since I am hoping to make a more detailed study of the genitalia of the Diptera later, and it has seemed preferable to present the essential facts in a preliminary paper, to serve as the basis of the more detailed study of the parts, and to call attention to the misinterpretation of the parts by recent investigators, since errors once established, are extremely difficult to eradicate. If such errors go unchallenged, they may be accepted as correct by those who have not the time or the inclination to investigate the matter for themselves. It is a very hopeful sign, however, that even in systematic entomology, those who describe morphological parts are beginning to be critical as to the correctness of the homologies indicated by the terms used, and it is to be hoped that the modern spirit of scientific exactness manifested in vertebrate osteology and kindred subjects, will eventually assert itself in entomological terminology, as it has long since done in the realm of vertebrate anatomy. However, until the students of insect morphology have worked out the homologies of the various structures throughout the orders of insects (as has been done by Comstock and his associates for the wing veins of insects) the systematists can hardly be blamed for using the mostconvenient terms (regardless of their correctness) in the particular groups in which they are working.

The parts of male Mecoptera have not been discussed in detail in the present paper, since the labelling of the figures will serve to indicate the homologies of the structures in question. I would call attention, however, to the fact that the genitalia of the *Bittacus*-group are very different from those of the *Panorpa*-group, and the genitalia of *Merope* are quite different from either, although *Merope* approaches more closely to the *Panorpa*-group than to the *Bittacus* group, as was shown in previous papers dealing with these insects. Such of the parts of the genitalia of the male Diptera (with the Mecoptera) as were not discussed in this paper, may be determined by referring to the labels of the figures, and tracing the same labels through the series, to the fundamental plan of the genitalia of insects in general given in figure 4.

Before leaving the subject of the genitalia of male insects, I would call attention to the evidence of relationship indicated by the genitalia of the different groups of insects, which serves to strengthen the conclusions regarding the inter-relationships of these groups reached through a comparison of other structures of the body than the genitalia. The character of the "larval" head and mouthparts, the nature of the cerci and terminal filament, and other structures of the body indicate that the ephemerids are among the most primitive of winged insects, and the character of the genitalia would bear out this view, since the parts of the male in certain ephemerids approximate the fundamental type extremely closely.

The head and mouthparts of certain Hymenoptera and Mecoptera indicate a very close relationship between the two groups, and their larvae are similar in many respects, so that the marked similarity in the genitalia affords additional evidence of a close relationship between the two orders indicated by other structures of the body. The Diptera resemble the Mecoptera more than any other insects in the nature of their head and mouthparts, thoracic structures, etc., and the remarkable similarity in the genitalia of the two groups leaves no room for doubt that the Mecoptera are among the nearest living representatives of the types ancestral to the Diptera, although recent Mecoptera are naturally not the ancestors of recent Diptera.

The genitalia of the Lepidoptera are very like those of the Trichoptera, thus bearing out the evidence of a very close relationship between these two groups of insects indicated by other structures of the body as well. The genitalia of certain Lepidoptera not figured in the present paper, indicate an approach to the Hemiptera (Homoptera) in some respects, thus tending to bear out the marked resemblance in the venation of the two groups of insects, but the Hemiptera are rather unique in many respects, and their genitalia are not as similar to those of the Mecoptera, as one might expect from the resemblance of the hemipterous mouthparts (labium, etc.) to those of the Mecoptera and their allies, although the genitalia of some Hemiptera are rather suggestive of those of certain Diptera and other insects derived from Mecoptera-like forebears. It is also rather surprising that the genitalia of the Trichoptera are not

more like those of the Mecoptera than they are, since there is considerable evidence that the Mecoptera (with the Neuroptera) are very like the ancestors of the Trichoptera.

In most cases, the evidence afforded by a study of the genitalia directly supports that drawn from other sources, which served as the basis for the grouping of insects into superorders given by us,[3] and in no instance would the character of the genitalia be incompatible with such a grouping. On the other hand, the nature of the genitalia of many insects offers no striking evidence of relationship one way or the other, and one must depend upon the study of other characters from as many different portions of the body as possible, to determine the inter-relationships of the orders of insects. Furthermore, insects are usually not uniformly primitive or specialized in all parts of their bodies, and an insect which is quite primitive in most respects may have the genitalia more or less specialized, while an insect which is otherwise fairly specialized may preserve the genitalia in a condition closely approximating the ancestral condition of the group to which it belongs. Thus it is largely a matter of luck in finding the right insect to illustrate the condition of genitalia which one feels sure must be exhibited by some member of the group, from evidences of relationship to another group of insects indicated by the general make-up of the body as a whole. Since I have not as yet succeeded in finding the forms (which I feel sure exist from a study of other features) connecting the Trichoptera with the Mecoptera and both of these with the Neuroptera, in the character of their genitalia, it is preferable to postpone further discussion of the evidence of relationship furnished by the genitalia until the series is complete. I would make use of this opportunity of requesting the privilege of examining the genitalia of such Trichoptera as anyone may be willing to lend for this purpose.

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## *ABBREVIATIONS*

The letter "t" written to the right and above an Arabic numeral indicates the tergite, while the letter "s" indicates the sternite of the segment in question.

a.....Apical appendage (apicappendix) of claspers.
ae.....Aedeagus or intromittent organ (penis, etc.).
b.....Penis thread of aedeagus (penisfilum or spirofilum).
c.....Cerci (parapodial plates in some cases).
co.....Columna, or part of aedeagus.
dv.....Dorsovalvae, or dorsal valves, possibly homologous with the structure labeled "s".
ea.....Epiandrium, or ninth tergite located above male genitalia.
en.....Penisvalvae or aedeagus.
ex.....Gonostyli, or genital styles (also called gonopods) possibly homologous with crustacean exopodites.
gs.....Basistylus or basal segment of genital style (also called gonostipes).
h.....Dististylus, or distal segment of genital style (also called cochliarium harpes, harpagones, parameres, etc.).
ha.....Hypandrium, or ninth sternite beneath male genitalia.
hv.....Hypovalvae, or valves of the hypandrium, located beneath male genitalia.
ib.....Interbasales, or interbasal plates which may unite to form the interbasis, or connective, between the bases of the genital styles. The label "ib?" indicates the parapenes, or processes which are not strictly homologous with the other structures labeled "ib."
p.....Gonocoxite, or genital coxite, homologous with crustacean protopodite.
pa .....Parandrium or pleural plate lateral to male genitalia.
pg.....Proctiger, or anus-bearing structure; also suranal plate or epiproct.
pp.....Paraprocts, or parapodial plates, homologous with Crustacean protopodites.
pr.....Same as pp.
ps.....Pseudostyli, or valves of eighth sternite.
pv.....Penisvalvae or aedeagus.
s.....Possible homologue of the sagittae of higher Hymenoptera.
sa.....Subapical appendix (subappendix) of claspers.
sb.....Surbasale, or surbasal plate.
sg.....Surstyli, or surgonopods (secondary claspers above genital styles).
sp.....Syneoxite, or united genital coxites (protopodites), also called gonocardo.
sr.....Styloreceptor, or plate of female for reception of male style.
ta.....Telaedeagus, or terminal portion of aedeagus.
tm.....Tectum, possible homologue of tegumen of higher Lepidoptera.
vv .....Ventrovalvae, possible homologues of volsellae of higher Hymenoptera.

## Explanation of Plates

Fig. 1.—Lateral view of terminal structures of male ephemerid *Blasturus cupidus*.

Fig. 2.—Lateral view of terminal structures of male tenthredinid *Sirex edwardsii*.

Fig. 3.—Genitalia of male tenthredinid *Tenthredella verticalis*. The parts shown were originally dorsal, but have become secondarily ventrally located through a torsion or revolution of the parts through one hundred and eighty degrees about the long axis.

Fig. 4.—Diagram of parts of genitalia of male ephemerid, ventral view.

Fig. 5.—Diagram of parts of genitalia of male sawfly, ventral view.

Fig. 6.—Dorsal view of terminal structures of male mecopteron *Chorista australis*.

Fig. 7.—Dorsal view of terminal structures of male dipteron *Gnophomyia tristissima*.

Fig. 8.—Genitalia of male sawfly *Dolerus collaris*. The parts shown were originally ventral, but have become secondarily dorsal as the result of torsion.

Fig. 9.—Terminal structures of male dipteron *Sciara sciophila*, the originally dorsal structures have been turned over so as to lie in a ventral position when in situ.

Fig. 10.—Dorsal view of terminal structures of the male dipteron *Erioccra fultonensis*.

Fig. 11.—Lateral view of terminal structures of male dipteron *Tipula valida*.

Fig. 12.—Dorsal view of terminal structures of male dipteron *Epiphragma* sp. (related to *E. fascipennis*).

Fig. 13.—Ventral view of terminal structures of male panorpid *Panorpa nebulosa*.

Fig. 14.—Lateral view of terminal structures of a male nymphal jassid (cicadellid).

Fig. 15.—Lateral view of terminal structures of male trichopteron *Philopotamus distinctus*.

Fig. 16.—Lateral view of terminal structures of male lepidopteron *Micropteryx Eriocephala*) *sepella*.

Fig. 17.—Ventral view of terminal structures of male panorpid *Panorpa lugubris*.

Fig. 18.—Dorsal view of terminal structures of male panorpid *Panorpodes* sp.

Fig. 19.—Lateral view of terminal structures of male lepidopteron *Micropteryx* (*Eriocephala*) *calthella*.

Fig. 20.—Lateral view of terminal structures of male panorpid *Panorpa lugubris*.

Fig. 21.—Lateral view of terminal structures of female dipteron *Sciara sciophila*.

Fig. 22.—Lateral view of male genitalia of dipteron *Eristalis tenax*.

Fig. 23.—Ventral view of terminal structures of male dipteron *Eristalis tenax*.
Fig. 24.—Lateral view of terminal segments of male and female dipteron *Sciara sciophila*, in coitu.
Fig. 25.—Dorsal view of terminal structures of male mecopteron *Merope tuber*.
Fig. 26.—Lateral view of terminal structures of male mecopteron *Bittacus pilicornis*.
Fig. 27.—Dorsal view of terminal structures of male dipteron *Chrysopila quadrata*.
Fig. 28.—Dorsal view of terminal structures of male mecopteron *Nannochorista dipteroides*, based on figure by Tillyard.
Fig. 29.—Lateral view of terminal structures of male homopteron *Psylla* sp.
Fig. 30.—Lateral view of terminal structures of male dipteron *Rhamphomyia mutabilis*.
Fig. 31.—Lateral view of terminal structures of male mecopteron *Boreus nivoriundus*.
Fig. 32.—Lateral view of terminal structures of male dipteron *Bittacomorpha* sp.
Fig. 33.—Dorsal view of male mecopteron *Panorpa maculosa*.
Fig. 34.—Lateral view of terminal structures of male mecopteron *Boreus brumalis*.
Fig. 35.—Lateral view of terminal structures of male dipteron *Ptecticus trivittatus*.
Fig. 36.—Ventral view of terminal structure of male dipteron *Limnophila rufibasis*.
Fig. 37.—Lateral view of terminal structures of male dipteron *Promachus fitchii*.
Fig. 38.—Lateral view of terminal structures of male dipteron *Ormosia innocens*.

# FLIES OF THE ANTHOMYIID GENUS PHAONIA ROBINEAU-DESVOIDY AND RELATED GENERA, KNOWN TO OCCUR IN NORTH AMERICA

BY J. R. MALLOCH

The present paper offers a revision of the species of the genus *Phaonia* in its widest sense, not with the idea that this is by any means a complete survey of our species, because there must be a large number still unknown to me, but with the intention of making it possible for students of this imperfectly known family to identify those species which have already been described, and to place before those students data bearing on characters which I have found valuable in the differentiation of the species. To this family, more so than to most dipterous groups, there has been shown an aversion by students, because of the fact that the generic limits and the characters for the definition of the genera have been but imperfectly understood. There is no good key for the identification of the genera, though a recent one by Herr P. Stein is a considerable advance in our knowledge.[1]

In several of my recent papers on different genera of the family I have given partial keys to the genera and intend finally to publish a key to the whole of the genera, but my material is not sufficient to warrant such a course at this time. I include in this paper a partial key to the genera related to *Phaonia* in the restricted sense, in the hope that it may permit of the more ready recognition of the forms treated in the paper.

Much of the material on which this paper is based belongs to the United States National Museum, but many specimens were lent to me by Mr. C. W. Johnson from his collection or that of the Boston Society of Natural History, and by Professor J. S. Hine from his own collection or from the material collected by him when on his trips to Mt. Katmai for the National Geographic Society. The collection of the Illinois State Natural History Society has always been available to me, and most of that material was collected by the late Mr. C. A. Hart and the author.

[1] Archiv. für Naturges., 1917, Abt. A, 1 heft, 1919.

Every effort has been made to place types or paratypes in the National collection at Washington, and the types of all new species belonging to the United States Bureau of Biological Survey will be deposited in that collection. A representative series has also been placed in the collection of the American Entomological Society.

*Definition of the Group*

Sixth wing-vein not reaching the margin of wing; hind tibia with one bristle, rarely two bristles, on posterodorsal surface; cheek without a slightly raised anteriorly rounded area on lower half or more, the surface of which is covered with more or less upwardly curved hairs, lower calyptra always distinctly protruded beyond upper; under surface of scutellum never with soft hairs; propleura bare; sternopleural bristles not in an equilateral triangle; thorax with at least two strong presutural dorsocentral bristles.

There are one or two species of the genus *Helina* R.–D. which may be confused with this group, but the partial key offered herewith should enable students to place any questionable forms in their proper positions.

*Habits of the Species*

The larvae of the species are mostly unknown. Those that are known to me are dealt with in the text. One has been found to parasitize the larvae or pupae of a tipulid fly, while one lives in much decayed tree stumps and another under the bark of recently felled trees.

The adults of many species occur on tree trunks or on leaves and are very active. They feed on sap exuding from wounds in trees and on nectar of flowers.

Many of the species occur in the far north and in mountainous regions, while very few are met with in the Plains states. Those I have found in Illinois are associated with wooded areas and are neither plentiful in numbers nor species.

Some species are common to Europe and North America, but in all cases where the recognition of European species as American has been recorded, I have had authentically identified European specimens for comparison with those from this country. This has been considered as essential because of the great similarity in color and general structure in this genus, and the fact that

many very useful characters for the differentiation of closely allied species are used in this paper for the first time. The lack of recognition of these characters by European workers causes a doubt to arise, as to the propriety of arbitrarily deciding whether or not a species should be placed in one or other of the categories in the key, when the character which I use is not mentioned in any available description.

*Descriptive Terminology*

In the keys and descriptions in this paper I have utilized the characters and terminology used in my most recent papers on the family. The names designating the various leg surfaces have been adopted from the paper written on the chaetotaxy of Cyclorrhapha by P. H. Grimshaw, which appeared in the Entomologists' Monthly Magazine in 1901. That paper was considered by the author at the time of its appearance as the first on the subject, but some years afterwards he informed me that he was in error in so considering it, as the method indicated for the leg surfaces at least had been used or suggested by a continental European author some years before.

In using the system referred to, the legs are assumed to be viewed when at right angles to the body, thus causing the same surfaces of all of them to lie in the same position and to receive the same names. There has been considerable confusion arising from the fact that it has not always been possible to determine whether an author meant what I call the ventral, or the posterior surface of the tibia when he referred to the inner side. The inner side may be in the terminology of one writer that side which lies next to the body, while in that of another it may apply to the surface which is opposed to the ventral or under side of the femur. A terminology which is essentially the same for all legs is indispensible for correct descriptions, especially in dealing with species which are as closely allied as are those in this family, and in all my papers the one now used has been adopted. I do not hold that it is a perfect system, but it is the only one which is thoroughly descriptive and not cumbersome in terminology, a fact which leads me to believe that it will come into more general use as the Muscaridae and Tachinidae find more students.

Dipterists who have carefully studied the legs of the species realize that there are more than four surfaces to the tibiae. Ordinarily one finds but four in descriptions of Muscaridae, upper, under, inner, and outer. These correspond, at least on the mid and hind legs, to those designated in my papers as dorsal, ventral, posterior, and anterior respectively. There are as a matter of fact very few strong bristles found on any of the four surfaces mentioned except at apices of the tibiae, the outstanding bristles being almost invariably situated on the other four surfaces which are between those listed and are termed the anteroventral, anterodorsal, posteroventral, and posterodorsal. The names are self explanatory.

A close examination of the hind tibia of *Phaonia errans* Meigen shows that the "calcar" so called is situated less than one-third of the tibial length from apex and on the posterodorsal surface, there are two bristles on the anterodorsal surface, and two or more on the anteroventral. The setulae on the median portions of the anterior and posterior surfaces are rather strong, but the dorsal and ventral surfaces are devoid of bristles or outstanding setulae. The names used in designating the surfaces of the tibiae apply also to the femora.

The thoracic chaetotaxy and the names applied to the bristles, and the regions where they are situated, are used in any book or paper on the Cyclorrhapha, are familiar to students the world over and require no elucidation except in a few cases. Recent attempts to separate the Muscaridae from the Anthomyiidae have not been entirely satisfactory, and in my opinion there are so many overlapping groups, genera, and species that it cannot be done, at least for the world's fauna. The most recent characters cited give to the Muscaridae (Muscidae auct.) hairs on either the hypopleura or pteropleura or both, while the Anthomyiidae have those sclerites bare. As a matter of fact there are many species that are very obviously anthomyiine in their affinities, which have hairs on either or both of the pleural sclerites, referred to not only in Phaoniinae, which are in my opinion most closely allied to the group containing *Musca*, but also in the Anthomyiinae. I have no hesitation in linking the two groups under the same family name, Muscaridae.

In the group treated in this paper I use the pleural characters just cited as of specific value, though in a few cases I am inclined to believe that they do not even admit of that interpretation.

There are some minor characters which I have introduced in the present paper, such as the structure and hairing of the fore tarsus, and especially that of the basal segment. The presence or absence of fine hairs adjacent to the bases of the notopleural bristles has some value as a character for the differentiation of species and even groups, but whether it is possible to use it successfully for species from a larger faunal area than is included in this paper I am unable to say.

In but few cases are there hairs on the prosternum in North American Phaoniinae, only one or two such occurring within the group under consideration, but many African and other exotic forms have hairs on this part of the thorax, as do all the species of the genus *Limnophora* R.–D., which is of cosmopolitan occurrence.

A few genera of Phaoniinae have the declivitous posterolateral portion of the mesonotum, caudad of wing base and extending to anterior margin of scutellum, with setulose hairs. I have found this character present in some Sarcophagidae and allied groups, and in a few exotic Phaoniinae.

There is very little variation in the wing-venation in Phaoniinae, though in a few cases the fourth vein is curved more or less forward. In no case is it angularly bent as in *Musca* and allied genera.

The hypopygia of closely allied species in Phaoniinae are usually very similar and, as a study of these would entail the expenditure of too much time and the number of species available now is far from the total of those occurring in this country, I have not attempted to use this character in the present paper.

### *Key to Genera and Subgenera*

1. The declivitous portion of mesonotum immediately in front of scutellum and above calyptrae with some hairs in center; first and third wing-veins setulose ..... 2

— The declivitous portion of mesonotum in front of scutellum and above calyptrae bare; at least the first wing-vein bare ..... 4

2. Prosternum bare; the bristle on posterodorsal surface of hind tibia (calcar) at or near middle of tibia. . . . . **Steinella** Malloch
— Prosternum hairy; calcar about one-third of the tibial length from apex of hind tibia. . . . . 3
3. Fourth wing-vein not curved forward at apex. . . . . **Smithomyia** Malloch
— Fourth wing-vein curved forward at apex. . . . . **Poecilophaonia** Malloch
4. Pteropleura with many fine erect hairs in center. . . . . 5
— Pteropleura bare . . . . . 6
5. Prosternum hairy. . . . . **Polietes** Rondani
— Prosternum bare. . . . . **Pseudophaonia** Malloch
6. Fourth wing-vein curved forward at apex; third vein setulose at base both above and below. . . . . **Bigotomyia** Malloch
— Fourth wing-vein not or almost imperceptibly curved forward at apex; third vein not setulose on both sides at base. . . . . 7
7. Cheek in male with one or two very strong upwardly curved bristles on lower margin just below anterior margin of eye in both sexes; frons in female with the anterior supraorbital bristle very strong and directed forward, the interfrontalia with or without a pair of cruciate bristles. **Dendrophaonia** new genus
— Cheek in both sexes without strong upwardly curved bristles as above, sometimes with some upwardly curved fine hairs or setulae; lower supraorbital bristle weak or absent, if present not directed forward. . 8
8. Hypopleura with some fine hairs on upper margin in front of spiracle; prealar bristle very long; fore tarsus with some long fine sensory hairs along the posterior or posteroventral side of basal segment; eyes distinctly hairy; presutural acrostichals not strong; third wing-vein bare. **Phaonia** R.–D. sen. str.
— Third wing-vein setulose at base below; thorax with some well developed presutural acrostichals; hypopleura with some weak hairs on upper margin in front of spiracle. . . . . subgenus **Rohrella** R.–D.
— Third wing-vein bare at base or the other characters not as above. . . . . 9
9. Fore tarsus in both sexes with the segments short and stout, the basal one densely hairy, the hairs erect, no long sensory hairs along posterior side; hypopleura hairy on upper margin in front of spiracle. **Phaonia** (group **serva**)
— Fore tarsus not as above, generally slender and with or without fine sensory hairs along posterior side; hypopleura hairy or bare. . . . . 10
10. Hypopleura usually with a few fine hairs below spiracle; presutural acrostichal bristles well developed. . . . . Subgenus **Euphemia** R.–D.
— Hypopleura bare; presutural acrostichals strong; female with a strong pair of cruciate bristles; metallic blue species. . . . . **Euphaonia** Malloch
— Hypopleura bare; presutural acrostichals poorly developed. . . . . 11
11. Arista with very distinct hairs; legs largely yellowish. **Phaonia** (group **fusca**)
— Arista almost bare, the hairs very seldom as long as basal diameter of arista; legs black. . . . . **Phaonia** (group **minima**)

It should be noted that several groups in *Phaonia* have been separated from that genus by European authors, and that a few of these are included in the above key. Those so listed are not in all cases so well distinguished as to deserve generic rank, but there is no doubt in my mind that with the growth of our knowledge of the genus and its allies some further division is inevitable.

I have endeavored to obtain the genotypes of the segregates above referred to, and the characters for *Euphemia* and *Rohrella*, as well as the segregates accepted as of generic value, have been attributed to them from an examination of the genotypes and allied species.

In the key to *Phaonia*, presented herewith, I have included all segregates of *Phaonia* which are not in my opinion sufficiently well differentiated from the true species of that genus to warrant their being placed in different genera.

**STEINELLA** Malloch

This genus is known to me only from South America and is represented solely by the genotype, *prima* Malloch.

**SMITHOMYIA** Malloch

*Generic characters.*—Differs from *Poecilophaonia* Malloch, which it most closely resembles, in having the fourth wing-vein bent forward at apex.

The first wing-vein is setulose above only, the third is setulose from base to near apex above and from base to near inner cross-vein below. The frons in female has the lower supra-orbital bristle strong and directed forward as in *Dendrophaonia*, and the interfrontalia with a pair of cruciate bristles. The prosternum and center of pteropleura are hairy, and there are some black hairs along the posterior margin of the metathoracic spiracle and some weaker hairs on lower posterior angle of hypopleura.

The only species of the genus, *concinna* Van der Wulp, occurs in Mexico and may yet be found in the southwestern United States.

**POECILOPHAONIA** Malloch

In my description of this genus I erroneously stated that the third vein is bent forward. It is the fourth vein that is thus bent.

This genus is known to me only from South America. The genotype is *flavithorax* (Stein), but there are some other species from South America which are referable to the genus.

Both this and the preceding genus have a bristle between the notopleurals, and the third vein setulose below beyond the inner cross-vein. It may be necessary to unite the genera if the females have the orbital bristling identical.

### **PSEUDOPHAONIA** Malloch

*Generic characters.*—Similar to *Phaonia* sens. str. in having the eyes hairy, prealar bristle long, hind tibial calcar present, third wing-vein bare at base, and fourth vein not curved forward at apex. Differs in having the pteropleura with numerous long erect hairs in center, and the hypopleura bare.

Genotype, *Pseudophaonia orichalcea* (Stein) Malloch.

#### *Synopsis of Species*

Both sexes with the fourth abdominal tergite golden pollinose; hind femur of male bare on ventral surface, the posteroventral surface with some fine erect hairs on basal half and a few bristly hairs at apex; narrowest part of frons decidedly wider than third antennal segment; mid tibia with ten to twelve posterodorsal and posteroventral bristles.....**orichalcea** (Stein)

Male with gray pruinosity on fourth as well as preceding tergites, female unknown, but undoubtedly as male in this respect; hind femur of male with moderately long erect fine hairs on entire length of ventral and posteroventral surfaces; narrowest part of frons not as wide as third antennal segment; mid tibia with about eight posterodorsal and three posteroventral bristles.....**griseocaerulea** new species

**Pseudophaonia orichalcea** (Stein)

*Aricia orichalcea* Stein, Berl. Ent. Zeitschr., 1897, p. 186.

Male and female.—Shining blackish blue, or black with a bluish tinge, rather densely grayish pruinescent. Frons opaque black, orbits, parafacials, face, and anterior third and the narrow upper margin of cheeks with golden pollinosity; antennae and palpi black. Thorax distinctly quadrivittate. Abdomen with a slender dorsocentral vitta and lateral checkerings black, the basal three tergites gray pruinescent, the fourth golden pollinose. Legs black. Wings slightly grayish. Calyptrae white, with black hairs at outer angle of upper calyptra. Halteres black in male, brown in female.

Male.—Eyes not densely, but distinctly hairy; frontal orbits narrow, bristled on their entire length, the two uppermost bristles on each orbit directed backward, some fine hairs along the inner side of orbits on upper half or more; arista plumose; cheek somewhat similar to that of species of the

genus *Pogonomyia*, the surface largely hairy (fig. 4). Thorax with four pairs of presutural acrostichals, and four pairs of postsutural dorsocentrals; sternopleurals 1 : 2. Abdomen elongate ovate; basal sternite bare; fifth sternite slightly emarginate at apex. Fore tibia with one or two weak median posterior bristles; fore tarsus stout, not longer than tibia, with sensory hairs as in *Phaonia errans* Meigen; mid femur with fine hairs on ventral surfaces; hind femur with a series of long bristles on anteroventral surface; hind tibia with a series of rather closely placed bristles on anteroventral surface, the anterodorsal surface with some outstanding setulae but no strong bristles, calcar long, and basad of it some erect setulae, the apex with three straight, strong, blunt-tipped spines on ventral surface, which are of the same length and longer than in allied species.

Female.—Frons over one-third of the head-width; each orbit with the anterior and sometimes the next supra-orbital bristle directed forward; cruciate bristles present but weak. Sternopleurals 1 : 3 or 1 : 4. Genitalia without thorns. Fore tibia with two or three anterodorsal bristles; mid femur with some bristles on basal half of anteroventral and posteroventral surfaces; mid tibia with but one posteroventral bristle; hind tibia with two or three anterodorsal and four or five anteroventral bristles.

Length, 8 to 9 mm.

Originally described from Craig's Mountain, Idaho. I have the type male before me now. I also have before me a male from Sherborn, Massachusetts, May 12, and a female from King and Bartlett Lake, Maine, August, 1895, sent to me by Mr. C. W. Johnson.

**Pseudophaonia griseocaerulea** new species

Male.—Similar in color to *orichalcea*, differing in having the fourth abdominal tergite colored as are the others, and the calyptrae and their fringes yellow.

In addition to the characters listed in the synopsis for separating it from the preceding species I may enumerate the following: the orbits are less strongly bristled, only one weak upper orbital is directed backward (fig. 5), and the orbital hairs are in line with the bristles instead of mesad of them; the basal abdominal sternite is hairy; the hind tibia has fewer and longer anteroventral bristles, the anterodorsal setulae are stronger and one at least assumes the proportions of a bristle, the posterior and posteroventral surfaces are furnished with long hairs, and the apical ventral bristles are not of uniform length and strength, only one being really long.

Length, 8.25 mm.

Type locality illegible on label, New Hampshire, August 27, 1912. *Solidago* flowers. The type bears also a label with the inscription "T. D. 4335," [U. S. N. M.].

**BIGOTOMYIA** Malloch

*Generic characters.*—Differs from *Phaonia* in having the fourth vein distinctly bent forward at apex, and the third with some setulose hairs at base.

Genotype, *Bigotomyia trispila* (Bigot).

*Key to Species*

1. Basal abdominal sternite with some setulose hairs: abdomen with a dorsal vitta and lateral checkerings black ..... **californensis** new species
— Basal abdominal sternite bare; abdomen with only a blackish dorsocentral vitta, without lateral checkerings ..... 2
2. Humeri black; eyes of male separated by width across posterior ocelli. **houghi** Stein
— Humeri yellowish testaceous; eyes of male separated by much less than width across posterior ocelli ..... **houghi** Stein variety

**Bigotomyia houghi** (Stein)

*Aricia houghi* Stein, Berl. Ent. Zeitschr., 1897, p. 177.

Differs from *californiensis* in having the legs entirely yellow.

Structurally similar to that species. Differs in having the hypopleura usually with a few hairs below spiracle and some on margin of spiracle at center; four or five anteroventral bristles on hind tibia; and the fourth wing-vein less noticeably curved forward at apex.

Length, 8 to 9 mm.

One of the commonest species of the genus, occurring in Canada, from Washington to Maine and as far south as middle California and Florida.

**Bigotomyia californiensis** new species

Male.—Black, very distinctly gray pruinescent. Second antennal joint, base of third, and the palpi ferruginous. Scutellum rufous, more or less blackened at base. Legs reddish yellow, coxae, almost all of fore femora, bases of mid and hind femora, and the entire tarsi black. Calyptrae whitish yellow. Halteres yellow.

Eyes long haired, separated at narrowest part of frons by less than width across posterior ocelli; longest hairs of arista much longer than width of third antennal joint; parafacial in profile a little broader than third antennal joint and about one-third as wide as height of cheek, the latter with numerous bristles which occupy a large portion of its surface, almost all of it posteriorly; bristles ascending facial ridge much above the vibrissa. Presutural acrostichal bristles absent; postsutural dorso-centrals 4; prealar bristle long; sternopleurals 1 : 2. Abdomen broadly ovate. Fore tibia without median bristle; mid femur with five or six strong bristles on basal half of posteroventral surface; mid tibia with two or three posterior bristles; hind femur

with a complete series of antero-ventral bristles; hind tibia with two antero-ventral and two antero-dorsal bristles, the calcar short. Costal thorn very small.

Female.—Similar in color to the male. Only the fore femora with the bases blackened.

Eyes less conspicuously haired than in male, separated at frons by one-third the width of head, at base of antennae by about three-fifths the width of head; orbits with numerous short setulose hairs in addition to the bristles. In other respects as the male.

Length, 8 to 9 mm.

*Type* (male), allotype, and several paratypes, San Antonio Canyon, California, July 25, 1907, (Hine), [Ohio University]. Paratypes, one female, Hilton, one female, Mount Lowe, one female, Mount Wilson, and one female, Pasadena, California. The last specimen is in the collection of the California Academy of Sciences, and the preceding three in the U. S. National Museum.

**DENDROPHAONIA** new genus

*Generic characters.*—Closely related to *Euphemia*, having distinct presutural acrostichal bristles, and the male orbits with bristles on the entire length from base of antennae to anterior ocellus. It differs, however, in having the cheek below anterior margin of eye with one or two long strong bristles which are upwardly curved (figs. 6, 7), and the lower supra-orbital bristle in female very strong and forwardly directed. The notopleural bristles are not surrounded with hairs, and the anterior intra-alar bristle is strong and almost in transverse line with the strong supra-alar. The hind tibia in both sexes has one or more bristles basad of the calcar and usually a series of long and short bristles on anterodorsal surface.

Genotype, *Spilogaster hilariformis* Stein.

*Key to Species*

1. Thorax with four pairs of postsutural dorsocentrals; hypopleura with some hairs on upper margin in front of spiracle; hind femur of male with a stout bristle near middle on posteroventral surface (fig. 20).
**querceti** Bouché

— Thorax with three pairs of postsutural dorsocentrals; hypopleura bare; hind femur of male with a few very short setulae on basal two-thirds (fig. 19) ..... **hilariformis** Stein

**Dendrophaonia querceti** (Bouché)

*Anthomyia querceti* Bouché, Naturgesch. d. Ins., 1, p. 82, 1834.

I have seen only one male of this species from America, taken at White Heath, Illinois.

I have a female taken at Gold Rock, Ontario, Canada, which may belong to a different species, having the hypopleura bare and the hind tibia with only the calcar on that surface, but do not describe it as I have insufficient material to warrant that course.

**Dendrophaonia hilariformis** (Stein)

*Spilogaster hilariformis* Stein, Berl. Ent. Zeitschr., 1897, p. 196.

This species is very common on tree trunks at Urbana, Illinois, but it is so alert that it is difficult to catch. I reared a series of specimens from larvae found feeding in a much decayed tree stump, in March 1915, at Urbana.

The adults habitually frequent the trunks of trees and sit normally head downwards, harmonising well with the bark and are very wary. The species is well distributed throughout the eastern United States, occurring as far south as Plummer's Island, Maryland, to my knowledge, but is rare in collections, possibly because of its habits.

The larva has six or seven branches to each prothoracic respiratory organ. These are very distinct in the puparium, being white, and are larger than those of *Phaonia harti*. The cephalic extremity of the puparium has many concentric ridges surrounding the mouth-opening. Metathoracic spiracles pedunculate, about four times as high as thick. Surface of puparium more distinctly striate than that of *harti* and the elevated points on the ventral transverse band larger. On each side of the anal opening in puparium there is a small circular button-like mark. Anal spiracles slightly elevated, their vertical length greater than their horizontal, the distance between them equal to their greatest length. Spiracular slits not radiating, each directed upward and outward, the central button distinct.

The larvae may be predaceous but I have no evidence of this. They were found along with the larvae of *Neodexiopsis basalis* (Stein) and evinced no predaceous tendencies in the breeding dish.

**PHAONIA** Robineau-Desvoidy

This genus as now limited contains species which have a strong bristle beyond middle on posterodorsal surface of hind tibia; the fourth wing-vein not or almost imperceptibly bent forward apically; third vein not setulose at base, or rarely so on under surface only; pteropleura bare; prosternum bare; cheek with or without fine hairs, or setulose above lower margin, never with one or two strong bristles below anterior margin of eye and near or on lower margin of cheek; female never with the lower supra-orbital bristle strong and forwardly directed; thorax with two strong presutural dorsocentrals.

Genotype, *Musca erratica* Fallen.

As previously stated and exemplified in the key to genera and subgenera in this paper, there are several groups in this genus, most of which are segregated in the following key to species. But there are many intermediate forms which cannot be definitely placed in any of the larger groups, so rather than add to the difficulty in identifying these by creating a multiplicity of genera based on a variable number of characters, I have followed the course of leaving them all in one composite genus until such time as our knowledge of the species and their habits warrants a further segregation. Should it be deemed necessary at any future time to erect genera for any of these segregates, consideration will have to be given to the genera proposed by the older European authors, which are at this time listed as synonyms of *Phaonia*.

*Key to Species*

1. Hypopleura with some fine hairs on upper margin in front of spiracle; eyes usually with distinct hairs ..... 2
— Hypopleura bare on upper margin in front of spiracle ..... 30
2. Legs entirely black, only the knees more or less reddish, sometimes the hind tibiae reddish when held up to the light ..... 3
— Legs with at least the tibiae reddish yellow ..... 16
3. Thorax with one or more pairs of strong outstanding presutural acrostichal bristles ..... 4
— Thorax without strong outstanding presutural acrostichal bristles, with fine hairs only ..... 10
4. Fore tibia without any strong posterior median bristles ..... 5
— Fore tibia with one or more strong median posterior bristles ..... 8

5. Vibrissal angle very much produced beyond a vertical line drawn from base of antennae (fig. 8); thorax with four pairs of postsutural dorsocentral bristles and one or two pairs of long presutural acrostichals. **protuberans** new species

— Vibrissal angle produced but little beyond a vertical line drawn from base of antennae (fig. 9) ..... 6

6. At least the abdomen bluish black; margins of calyptrae much darker than their discs, dark brown or fuscous ..... **caerulescens** Stein

— Abdomen and thorax both black; margins of calyptrae yellowish ..... 7

7. Neither sex with a distinct median posterior bristle on fore tibia; base of wing conspicuously yellow; neither sex with anterodorsal bristles on mid tibia ..... **serva** Fallén

— Female with one or two bristles on anterodorsal surface of both fore and mid tibiae; base of wing not conspicuously yellow. **savonoskii** new species

8. Margins of calyptrae brownish or blackish, much darker than their discs; bluish black species; both notopleurals surrounded with fine hairs. **caerulescens** Stein

— Margins of calyptrae yellowish ..... 9

9. Thorax with four pairs of postsutural dorsocentral bristles; only the posterior notopleural bristle surrounded with fine hairs. **protuberans** new species, female

— Thorax with three pairs of postsutural dorsocentral bristles. **versicolor** Stein[2]

10. Hind tibia with a strong outstanding bristle near base on posterodorsal surface; fore tibia without short dense hairs on ventral surface. **basiseta** Malloch

— Hind tibia with only the calcar on posterodorsal surface, which is situated about one-fourth from apex, or the fore tibia has short dense hairs on ventral surface ..... 11

11. Fore tarsus without any long outstanding fine sensory hairs along the posterior or posteroventral margins of basal segment, even the one at apex short and setulose when present, the entire surface with dense short hairs which are sometimes curled at apices as if singed ..... 12

— Fore tarsus with several long fine outstanding sensory hairs along the posteroventral margin of basal segment, the length of which is usually greater than the diameter of the segment, or the segment has the short hairs rather sparse and subdecumbent and not curled at apices ..... 14

12. Fore tibia without any strong bristles or long outstanding hairs on the posterior or posteroventral surfaces ..... **consobrina** Zetterstedt

— Fore tibia with one or more bristles or outstanding setulose hairs on posterior or posteroventral surfaces ..... 12a

12a. Mid tibia without any anterodorsal bristles; fore tibia with a very fine long setulose hair on posteroventral surface; hind femur with some long bristles on basal half of posteroventral surface ..... **incerta** new species

— Mid tibia with one or more anterodorsal bristles; fore tibia with one or two outstanding hairs or bristles ..... 13

[2] I have not seen this species.

13. Fore tibia with dense erect setulose hairs on ventral surfaces except on basal third, the length of which is about as great as the diameter of the tibia; hind femur without long bristles on basal half of posteroventral surface, usually with very short bristles or setulae.
**monticola** Malloch
— Fore tibia without such hairs; hind femur with some long bristles on basal half of posteroventral surface.....**brunneinervis** Stein
14. Thorax with three pairs of postsutural dorsocentral bristles; fore tibia without any posterior median bristles.....**fraterna** new species
— Thorax with four pairs of postsutural dorsocentral bristles.....15
15. Only the posterior notopleural bristle surrounded with fine hairs; basal abdominal sternite bare.....**tipulivora** new species
— Both notopleural bristles surrounded with fine hairs; basal abdominal sternite hairy.....**nigricans** Johannsen
16. Third wing-vein with a few fine hairs at base below; basal segment of fore tarsus with the sensory hairs along posteroventral margin short but distinct; basal abdominal sternite bare.....17
— Third wing-vein bare at base; thorax with two or three pairs of strong presutural acrostichal bristles, and four pairs of postsutural dorsocentrals.....**texensis** new species
— Third wing-vein bare at base; thorax with two pairs of fine presutural acrostichals and three pairs of postsutural dorsocentrals.
**pallidula** Coquillett
— Third wing-vein bare at base below; species not as above in other respects; thorax without strong presutural acrostichals.....18
17. Thorax with four pairs of postsutural dorsocentral bristles; hypopleura with some microscopic hairs near lower posterior angle; metathoracic spiracle large, without small black hairs on its lower margin at middle.
**quieta** Stein
— Thorax with three pairs of postsutural dorsocentral bristles; hypopleura without hairs near lower posterior angle; metathoracic spiracle small, with two or three small black hairs on its lower margin at middle.
**pulvillata** Stein
18. Sensory hairs on posteroventral margin of basal segment of fore tarsus conspicuous[3].....19
— Sensory hairs on posteroventral margin of basal segment of fore tarsus inconspicuous or absent.....26
19. Antennae and palpi, or at least the former partly yellow.....20
— Antennae and palpi black.....23
20. Hind femur with long hairs on almost the entire length of posteroventral surface.....**quieta** Stein
— Hind femur without long hairs on posteroventral surface, sometimes with one or two bristles.....21

[3] I have not seen *perfida* Stein, so place it in both segregates here. I have arbitrarily accepted the hypopleura as hairy above in front of spiracle in this species.

21. Palpi blackened apically; fourth wing-vein slightly curved forward at apex; basal abdominal sternite bare; tarsi black....**erratica** Fallen[4]
— Palpi fuscous; fourth wing-vein not curved forward at apex; third antennal segment black; abdomen with golden pollinosity.
**aurea** new species
22. Tarsi black; hind femur with at least one bristle on posteroventral surface; humeri black.....**rufibasis** Malloch
— Tarsi yellow; hind femur bare on posteroventral surface; humeri yellowish.
**perfida** Stein
23. Legs almost or entirely black.....**nigricans** Johannsen
— Legs with at least the tibiae reddish yellow.....24
24. All femora yellowish; mid tarsi with the short spines along the anteroventral and posteroventral margins continued to bases of segments two to four or almost so....**errans** variety **completa** new variety
— At least the fore femora largely or entirely blackish; mid tarsi with the short spines on segments two to four confined to apical halves.....25
25. Fore femora largely and mid femora rarely partly blackened.
**errans** Meigen
— All femora largely blackened.....**varipes** Coquillett
26. Thorax with three pairs of postsutural dorsocentral bristles; hind femur in male with long setulose hairs on basal half of ventral surfaces and a series of long bristles on apical half of anteroventral.
**subfusca** new species
— Thorax with four pairs of postsutural dorsocentral bristles; hind femur not as above.....27
27. Hind femur of male with long hairs on almost the entire length of posteroventral surface; antennae and palpi partly black; tarsi black.
**quieta** Stein
— Hind femur without long hairs on posteroventral surface; antennae and palpi black, if partly yellow the tarsi are black or the fourth tergite of abdomen is partly yellowish apically.....27
28. Eyes not very widely separated, the frons at narrowest part not wider than third antennal segment; tarsi and humeri yellowish; hind tibia with only the calcar on posterodorsal surface.....**perfida** Stein
— Eyes separated at narrowest part of frons by much more than width of third antennal segment; hind tibia with a bristle basad of the calcar on posterodorsal surface.....29
29. Tarsi and apex of fourth abdominal tergite yellowish; hind femur of male with an irregular double series of short black bristles on apical half of posteroventral surface; hind tibia of male with long hairs on posteroventral surface.....**deleta** Stein
— Tarsi and entire body black; hind femur of male without bristles and hind tibia without hairs as above.....**soccata** (Walker)

[4] This species does not occur in this country so far as I am at present aware. It is inserted in the key because it is the genotype of *Phaonia* and to show its relations.

30. Entire insect including legs, antennae, and palpi black.....31
— At least some part of legs, antennae, or palpi yellowish or reddish....40
31. Hind femur of male very much curved, very conspicuously swollen on ventral surface about one-third from apex, the apex of swollen part furnished with a tuft of long downwardly directed bristles, that part of surface from tuft to apex with short stiff hairs; eyes separated by less than width across posterior ocelli.....**frenata** (Holmgren)
— Hind femur straight or but slightly curved and not as above.....32
32. Prealar bristle at least half as long as the one behind it.....33
— Prealar bristle not over one-third as long as the one behind it.....38
33. Thorax with three pairs of dorsocentral bristles.....33a
— Thorax with four pairs of dorsocentral bristles.....34
33a. Arista almost bare; fore tibia with one or two median posterior bristles in female; fore tarsus without fine erect hairs basally.
**alticola** new species
— Arista plumose; fore tibia in female without posterior median bristle; fore tarsus as above.....**azygos** new species
34. Bases of wings and the calyptrae bright orange yellow.....35
— Bases of wings and calyptrae not bright orange yellow, the latter sometimes pale yellowish.....36
35. Halteres orange yellow; mid and hind femora without conspicuous bristles on ventral surfaces except on anteroventral surface of the latter.
**citreibasis** Malloch
— Halteres with black knobs; anteroventral and posteroventral surfaces of mid and hind femora with strong bristles, those on posteroventral surface of hind pair not extending to apices..**atrocitrea** new species
36. Frons of male at narrowest part not wider than third antennal segment; calyptrae white, the lower one with the margin fuscous and much darker than the disc; longest hairs on arista distinctly longer than its basal diameter.....**dissimilis** new species
— Frons of male at narrowest part much wider than third antennal segment; calyptrae white or yellowish, the margin of lower one not conspicuously darker than the disc; longest hairs on arista not as long as its basal diameter.....37
37. Calyptrae yellowish; basal abdominal sternite bare; glossy black species; the thorax and abdomen without distinct pruinescence or markings.
**imitatrix** Malloch
— Calyptrae white; basal abdominal sternite hairy; thorax and abdomen with distinct pruinescence, the former with four black vittae, the latter with a black dorsocentral vitta.....**albocalyptrata** Malloch
38. Hind femur straight, with long fine bristles on entire length of anteroventral and basal half of posteroventral surfaces; calyptrae fuscous; basal abdominal sternite bare.....**fuscisquama** (Van der Wulp)
— Hind femur slightly curved, dilated on apical third and with closely placed bristles from one-third or more of the femoral length to apex on anteroventral and posteroventral surfaces, the bristles becoming longer apically; calyptrae yellowish or whitish; basal abdominal sternite with one or two fine hairs.....39

39. Hind femur with a short stout downwardly directed bristle about one-fourth of the femoral length from apex on the posteroventral surface, in addition to the long fine bristles.....**morrisoni** new species
— Hind femur without a bristle as described above....**minima** Malloch
40. Thorax with well differentiated presutural acrostichal bristles, and four pairs of postsutural dorsocentrals; hypopleura sometimes with a few hairs in middle below spiracle or on upper margin in front of spiracle; sometimes the palpi of the female are dilated and the fourth tergite in same sex is distinctly longer than third.....41
— Thorax without well differentiated presutural acrostichal bristles; if these are moderately well developed there are only three pairs of postsutural dorsocentrals present, or the posterior bristles on mid tibia are not in a single series and the hypopleura is bare.....48
41. Legs, including the coxae and tarsi, entirely yellow; cross-veins of wings not darker than the other veins; fore tarsus with a few outstanding sensory hairs along the posteroventral surface of basal segment; hind femur without long bristles on basal half of posteroventral surface; neither notopleural bristle with hairs at base.**marylandica** new species
— Legs with at least the tarsi black; cross-veins sometimes very conspicuously infuscated .....42
42. Cross-veins of wings not at all noticeably darker than the other veins; abdomen with a blackish dorsocentral vitta and no distinct lateral blackish spots or checkerings; abdomen in female in known species with the fourth tergite distinctly longer than the third; hypopleura with usually a few hairs on middle just below spiracle.....43
— Cross-veins of wings very noticeably infuscated; fourth tergite of abdomen in female not elongated.....45
43. Posterior notopleural bristle without fine hairs adjacent to its base. **harti** new species
— Posterior notopleural bristle with some fine hairs adjacent to its base..44
44. Apex of scutellum reddish yellow; presutural acrostichal bristles moderately widely separated, in pairs; frons of female with a pair of interfrontal cruciate bristles.....**striata** Stein
— Apex of scutellum not yellowish, concolorous with disc; presutural acrostichal bristles almost uniserial, not in distinct pairs; frons of female without cruciate interfrontal bristles.....**uniseriata** new species
45. Outer cross-vein of wings straight or very slightly curved; abdomen with a dorsocentral vitta and lateral checkerings black; anteroventral bristles on hind femur short and strong....**brevispina** new species
— Outer cross-vein curved but not conspicuously so; abdomen with a black dorsocentral vitta; anteroventral bristles on hind femur long on apical half, their length exceeding diameter of femur...**fuscicauda** Malloch
— Outer cross-vein of wings very conspicuously curved forward in middle; abdomen with a dorsocentral vitta and lateral spots on each tergite blackish .....46

46. Hypopleura usually with a few hairs on upper margin in front of spiracle; all femora largely infuscated basally; palpi rufous yellow.
**texensis** new species
— Hypopleura without hairs on upper margin in front of spiracle.....47
47. Palpi rufous yellow; hypopleura bare.
**texensis** variety **flavofemorata** new variety
— Palpi largely or entirely black; hypopleura with some hairs in middle, just below spiracle.....**limbinervis** Stein
48. Thorax with four pairs of postsutural dorsocentral bristles; hind tibia with a strong bristle basad of the calcar on the posterodorsal surface; some fine hairs at bases of both the notopleural bristles; prealar bristle very long.....**aberrans** Malloch
— Thorax with four pairs of postsutural dorsocentral bristles; hind tibia with only the calcar on posterodorsal surface; mid tibia with three or four bristles on posterior surface which are not arranged in a single series; arista pubescent; prealar minute or absent; no hairs at base of notopleurals.....**alaskensis** new species
— Thorax with three pairs of postsutural dorsocentral bristles; hind tibia with a bristle basad of calcar on posterodorsal surface; posterior notopleural bristle with some fine hairs adjacent to its base; hind femur of male with long bristly hairs on all ventral surfaces from base to beyond middle.....**subfusca** new species
— Thorax usually with three pairs of postsutural dorsocentral bristles; hind tibia with only the calcar on posterodorsal surface; usually no hairs at bases of notopleural bristles.....49
49. Thorax entirely, abdomen at least partly yellow.....50
— Thorax and abdomen largely or entirely black.....52
50. Head including antennae and palpi black; abdomen in male glossy black on apical half; eyes of male at narrowest part of frons separated by not more than the width of third antennal segment..**nigricauda** Malloch
— Head, including antennae and palpi, largely or entirely yellow.....51
51. Eyes in male widely separated, the frons one-fourth of the head width; frons in both sexes largely fuscous.....**flava** Stein
— Eyes in male widely separated, the frons one-fourth of the width of head; entire head in both sexes yellow.....**pallida** (Stein)
52. Scutellum partly or entirely yellow, contrasting sharply with disc of mesonotum .....53
— Scutellum black, concolorous with disc of mesonotum.....58
53. Basal half of abdomen and the entire scutellum testaceous yellow; prealar bristle very short.....**flavibasis** Malloch
— Abdomen entirely black .....54
54. Fourth wing-vein slightly curved forward apically; fore tibia in female with two anterodorsal and two posterior bristles; prealar bristle very long.....**curvinervis** new species
— Fourth wing-vein straight or slightly deflected at apex, not curved forward; fore tibia with or without a median posterior bristle.....55

55. Thorax with a pair of presutural acrostichal bristles; prealar bristle long. **solitaria** Stein
— Thorax without differentiated presutural acrostichal bristles.....56
56. Humeri not paler than adjoining portions of dorsum of thorax. **apicata** Johannsen
— Humeri yellowish testaceous at least in part.....57
57. Prealar bristle not over half as long as the bristle behind it; tarsi black; eyes of male separated by width across posterior ocelli. . **bysia** (Walker)
— Prealar bristle over half as long as the one behind it; tarsi yellow; eyes of male separated by more than width across posterior ocelli; longest hairs on arista longer than width of third antennal segment. **winnemanae** Malloch
58. Prealar bristle minute or absent; thorax and abdomen glossy black, with faint gray pruinescence; legs, except tarsi, yellow; hind tibia with two anterodorsal bristles in each sex.....**parviceps** Malloch
— Prealar bristle almost or quite half as long as the bristle behind it....59
59. Hind tibia with two equally long anterodorsal bristles; third wing-vein not setulose at base below; longest hairs on arista not as long as width of third antennal segment; shining black species with distinct but not very dense grayish pruinescence on thorax and abdomen; cross-veins of wings not noticeably infuscated.....60
— Hind tibia either with one anterodorsal bristle or with one long and one very short bristle on that surface; longest hairs on arista distinctly longer than width of third antennal segment except in *prisca* Stein; subopaque black species, with very dense gray pruinescence; third wing-vein sometimes with some weak setulae at base below.....61
60. Third antennal segment in male normal, not abnormally large and broad; fore tibia in male without median posterior bristle; mid tibia with one posterior bristle basad of middle; some fine hairs at base of posterior notopleural bristle.....**trivialis** new species
— Third antennal segment in male very large and broad, not as noticeably so in female; fore and mid tibiae in both sexes with two posterior bristles; no hairs at base of either of the notopleural bristles. **laticornis** new species
61. Hind tibia with the apical posterodorsal bristle as strong and large as the anterodorsal and nearly as large as the dorsal one (fig. 22); mid femur with one bristle basad of middle on posteroventral surface; third vein setulose at base below; cross-veins infuscated. **atlanis** new species
— Hind tibia with the apical posterodorsal bristle much smaller and weaker than the anterodorsal one; mid femur with more than one posteroventral bristle.....62
62. Cross-veins of wings distinctly, often conspicuously, infuscated; third vein often with some weak setulose hairs at base below; hind tibia usually with one long and one very short bristle on anterodorsal surface; hind femur without distinct bristles on posteroventral surface. **fusca** Stein

— Wing without distinct infuscation on cross-veins; third vein bare at base; hind tibia with one strong anterodorsal bristle; hind femur in both sexes with distinct bristles on posteroventral surface.....63

63. Tarsi black; hind femur with some moderately long strong bristles on basal two-thirds of posteroventral surface; longest hairs on arista at least as long as width of third antennal segment; interfrontalia not interrupted.....**diruta** Stein

— Tarsi yellow; hind femur with fine bristles on almost the entire length of posteroventral surface; longest hairs on arista shorter than width of third antennal segment; interfrontalia interrupted above middle.

**prisca** Stein

**Phaonia protuberans** new species

Male and Female.—Black, distinctly shining, with rather dense whitish pruinescence. Thorax quadrivittate. Abdomen with a poorly defined subtriangular dorsocentral spot and lateral checkering on each tergite, black. Legs black. Wings subhyaline, veins slightly paler at bases. Calyptrae and halteres yellow.

Male.—Eyes rather densely pale haired; narrowest part of frons about as wide as third antennal segment; orbits with long setulose hairs below, which become much shorter above and extend to anterior ocellus; profile as in figure 8. Thorax with two pairs of presutural acrostichals and four pairs of postsutural dorsocentrals; hypopleura with a few hairs on upper margin in front of spiracle. Abdomen narrowly ovate, basal sternite bare, fifth with a broad deep excision. Fore tibia unarmed at middle, the hairs on apical half of ventral surface subcrect but not very long; fore tarsus without long sensory hairs on posteroventral margin of basal segment, moderately densely clothed with short erect fine hairs; mid femur with about nine bristles on basal half on posteroventral surfaces which are in an irregular series; mid tibia with three long posterior bristles; hind femur with a series of anteroventral, and a few short posteroventral bristles on basal half; hind tibia with two anterodorsal and two anteroventral bristles, the anterior and posterior surfaces with the setulae stronger than usual.

Female.—Differs from the male in having the frons over one-third of the head-width, the orbits laterad of the bristles with rather long setulose hairs, the fore tibia with two posterior bristles, and the fore tarsus shorter.

Length, 8 to 9 mm.

*Type*—male, Mt. Washington, New Hampshire, alpine, (G. Dimmock), [U. S. National Museum]. *Allotype*, female, Mt. Washington, New Hampshire (Coll. Coquillett). *Paratypes*, females, White Mountains, New Hampshire (Morrison); Mt. Washington, New Hampshire, August 16, 1916, 2500 feet (C. W. Johnson); four males and one female, Mt. Marcy, New York, above the 4800 feet level, July 21 and 27, on flowers of *Potentilla tridentata* and *Arenaria groenlandica*, (J. Bequaert).

This species belongs to the same group as the European *alpicola* Zetterstedt, *chalcinata* Pandell, and *lugubris* Meigen. It differs, however, from all of these in one or more characters.

**Phaonia serva** (Meigen)

*Anthomyia serva* Meigen, Syst. Beschr., 5, p. 86, 1826.

This very common European species may be readily distinguished from any of its allies by the characters given in the key to species. In color and habitus it resembles *protuberans*. Normally there are but three pairs of postsutural dorsocentral bristles present, but sometimes there are four pairs. One pair taken in the White Mountains, by Morrison, which I have before me, have four pairs of postsutural dorso-centrals, but differ in no other manner from normal specimens from Europe and this country. The variation percentage in number of postsutural dorsocentrals is very small, but occasional aberrant examples occur in most species, and to prevent errors in identification, these must be carefully compared with species they resemble in other respects, before their description as new species.

Length, 7.5 to 8 mm.

I have seen examples of this species from Maine, Massachusetts, and New Hampshire.

**Phaonia savonoskii** new species

Female.—Similar to *protuberans* in color and markings.

Structurally similar to *serva*, distinguishable from it by the bristling of the fore and mid tibia, the former having one or two and the latter two anterodorsal bristles near middle.

Length, 9 mm.

*Type*.—Savonoski, Naknek Lake, Alaska, June 1919, (J. S. Hine).

Type returned to Professor Hine, who collected it on his last trip to the Mt. Katmai region for the National Geographic Society. Three female paratypes, Healy, Alaska, July 6, 1921, (J. M. Aldrich), [U. S. N. M.].

**Phaonia caerulescens** (Stein)

*Aricia caerulescens* Stein, Berl. Ent. Zeitschr., 1897, p. 187, 1897.

This species is readily separated from its allies by the bluish black color of the abdomen and the characters given in the key to species. The fore tarsi are similar to those of *protuberans*

and *serva*, and the fine hairs surrounding bases of the notopleural bristles are present as in *serva*. The fore tibia in either sex may have or lack the posterior median bristles.

I have seen this species from Moscow (*type*), Julietta, and Kendrick, Idaho; Los Gatos, California; Seattle, Washington and Cache Junction, Utah.

It occurs in February, and on till May, usually frequenting the flowers of willows.

**Phaonia versicolor** Stein

*Phaonia versicolor* Stein, Arch. für Naturges., abt. A, heft 9, 1918, p. 16, 1920.

This species, which was described from one female, is unknown to me. The type was obtained by Dr. Aldrich, in Marshall Pass, Colorado. It may not be related to the species with which I have associated it in my key, but I accept Stein's comparisons as indicating that it is.

Length, similar to *serva*.

**Phaonia basiseta** Malloch

*Phaonia basiseta* Malloch, Trans. Amer. Ent. Soc., XLVI, p. 133, 1920.

I have seen no additional material since describing the species, except some more specimens from Waubay, South Dakota, and Alaska. The species may be separated at once from its allies by the presence of the sub-basal bristle on posterodorsal surface of hind tibia. The fore tarsi are as in *serva*, and there are sparse hairs adjacent to bases of both the notopleural bristles.

Length, 7 mm.

Localities, Bozeman, Montana; Waubay, South Dakota, and Healy, Alaska, July 6, 1921, (J. M. Aldrich).

This species is most closely related to the European *basalis* Zetterstedt, having the same bristling of the legs and the same habitus as in that species. But *basalis* has the femora and tibiae reddish yellow, and the thorax and abdomen with yellowish gray pruinescence, while the abdomen has only a black dorsocentral vitta and no lateral checkerings.

The European species *morionella* Bezzi has the same color and habitus as *basiseta*, but the eyes are much more widely separated, the vibrissal angle is very much produced, and there are only three pairs of postsutural dorsocentral bristles on thorax.

**Phaonia consobrina** (Zetterstedt)

*Anthomyza consobrina* Zetterstedt, Ins. Lapp., p. 665, 1834.

I have before me a European male of this species, obtained from Mr. R. Frey, which was named by Stein. The latter records the species from this country, basing his identification on specimens taken in Colorado. I have not seen his specimens, and have seen no examples from this country which are identical with the one from Europe. In his paper Stein gives a key to the species of the genus, and judging from that I consider it probable that what he had before him was not *consobrina*, but *brunneinervis* Stein, as his type specimens runs down to *consobrina* in the key. The European specimen I have is quite different from *brunneinervis*, so we may retain the latter in our list, though I fear we have no grounds for the retention of *consobrina*.

Length, 8 mm.

**Phaonia incerta** new species

Male.—Similar in color to *consobrina* and *brunneinervis*. The calyptrae are, however, white with the margins faintly yellowish and not yellowish throughout; the wings are but slightly infuscated at bases, whereas in the other species they are slightly but distinctly brownish at base and along the courses of the veins on basal half or more; the large black subtriangular black mark on each abdominal tergite is more distinct than in *consobrina*.

Eyes densely hairy, the hairs about twice as long as in *consobrina*, frons similar, the orbits with fine short hairs on posterior half, bristled on anterior half; arista with the longest hairs not much longer than its basal diameter. Fore tibia with a fine long setulose hair on posterior surface beyond middle; mid femur with three or four bristles on basal half of posteroventral surface and also numerous long hairs; mid tibia without any anterodorsal bristles, with four on posterior side in an irregular series, and two on posteroventral surface; hind femur with a complete series of bristles on anteroventral surface and some on basal half of posteroventral; hind tibia with two or three anterodorsal and anteroventral bristles, the anterior and posterior hairs setulose but not very long; apical posterodorsal bristle small but distinct.

Length, 7 mm.

*Type*.—Yakutat, Alaska, (J. S. Hine), [Ohio State University].

This species resembles both *consobrina* and *brunneinervis*, being distinguished from the former as indicated in the foregoing description, and from the latter by the lack of anterodorsal bristles on mid tibia, and the much weaker setulose hairs on the posteroventral surface of the fore tibia.

This may be the species which I have already seen from the Southwest and considered as a variety of *brunneinervis*.

**Phaonia monticola** Malloch

*Phaonia monticola* Malloch, Trans. Amer. Ent. Soc., XLIV, p. 266, 1918.

This species is readily separated from its allies by the dense erect hairs on the ventral surfaces of the apical two-thirds of the fore tibia in both sexes, and by the presence of anterodorsal bristles on mid tibia.

I have seen this species from New Mexico (*type*), Colorado, and Labrador.

This is undoubtedly the species Stein records as *morio* Zetterstedt from this country.

I obtained males of the European species from three correspondents for comparison with my North American examples, and believe that the forms are different though closely related. The posteroventral bristles on the hind femur in my specimens of *morio*, from Finland and Sweden, are much longer than in those from America, and there are several minor distinctions present which prevent me uniting them at this time, though an examination of a larger series of both may ultimately result in that course being followed. I am of the opinion that the Italian specimens sent me as *morio* are not that species, but do not desire to go into the matter of distinctions in extralimital material at this time.

**Phaonia brunneinervis** (Stein)

*Aricia brunneinervis* Stein, Berl. Ent. Zeitschr., 1897, p. 183, 1897.

I have the type male of this species before me. As stated in the remarks under *consobrina*, I think that this is the species Stein records under that name from Colorado.

I have seen the species from Craig's Mountains, Idaho (*type*); Tennessee Pass, Colorado, and Gallatin County, Montana.

**Phaonia fraterna** new species

Male.—Similar to *serva* in color, differing in having the wings slightly brownish, not yellowish basally, the cross-veins noticeably, but not conspicuously darkened. Abdomen with a rather large subtriangular dorsocentral black mark on each tergite, and some lateral black checkerings.

Eyes long haired; narrowest part of frons as wide as distance across posterior ocelli; orbits setulose to above middle; parafacial as wide as third antennal segment, not narrowed below; face receding below; cheek twice as high as width of parafacial, with several series of marginal bristles; third antennal segment about 1.5 as long as second, its apex about one-fourth from mouth-margin; arista short haired. Presutural acrostichals not differentiated; postsutural dorso-centrals three; prealar long and strong; hypopleura with some hairs on upper margin in front of spiracle. Abdomen short ovate, basal sternite bare, fifth with a broad rounded posterior excision, rather densely hairy on sides apically, without strong bristles. Fore tibia without long hairs or bristles; fore tarsus slender, exceeding length of tibia; mid legs lacking in type; hind femur with a complete series of bristles on anteroventral surface, which are weaker basally, and a series on basal half of posteroventral surface; hind tibia with two anterodorsal, and two anteroventral bristles. Outer cross-vein curved; last section of fourth vein twice as long as preceding section.

Length, 6 mm.

*Type.*—Lunenburg, Massachusetts, May 19, 1916, (S. M. Dohanian), [U. S. N. M.].

Apparently closely related to *confluens* Stein, of Europe. I have not seen this species but the arista is described as long haired and the hind tibia more bristly.

**Phaonia tipulivora** new species

Male.—Black, slightly shining, densely grayish pruinescent. Frons parafacials, face, and cheeks almost silvery; antennae and palpi black. Thorax with four black vittae. Abdomen with a series of poorly defined but distinct black subtriangular spots and, when seen from the side, with some lateral black checkerings. Legs black, tibiae brownish. Calyptrae white. Halteres yellow.

Eyes densely hairy; narrowest part of frons about as wide as distance across posterior ocelli; interfrontalia almost obliterated above middle; orbits setulose nearly to anterior ocellus; parafacial as wide as third antennal segment, not appreciably narrowed below; cheek nearly twice as high as width of parafacial, with several series of bristles on lower margin; third antennal segment about 1.75 as long as second; arista with its longest hairs not as long as width of third antennal segment; palpi normal, setulose. Thorax without differentiated presutural acrostichal bristles; postsutural dorsocentrals four; prealar very long; hypopleura hairy on upper margin in front of spiracle; sternopleurals 1 : 2. Basal abdominal sternite bare, fifth as in *fraterna;* abdomen broadly ovate. Fore tibia with two or three posterior median bristles; fore tarsus slender, distinctly longer than tibia, with a few long sensory hairs along the posteroventral margin; mid femur with about six bristles on basal half of posteroventral surface; mid tibia with six or seven bristles in a double series on posterior side; hind femur with a complete series

of anteroventral bristles and a partial series on basal half of posteroventral surface; hind tibia with two anterodorsal and two anteroventral bristles, the anterior and posterior surfaces with some short setulose hairs on middle. Outer cross-vein curved.

Female.—Similar to the male in color and bristling of the legs. Interfrontalia without hairs on sides. Fore tibia with two posterior bristles; hind femur with a few weak posteroventral bristles.

Length, 9 mm.

The puparium is brownish red, shining, cylindrical, the extremities rounded, surface with microscopic transverse striae and a less distinct irregular network of short linear impressions. The metathoracic spiracles are elevated, about as high as thick, glossy; each segment has a transverse series of minute wart-like elevations which does not extend clear round the body; being widely interrupted ventrally, the apical segment having the transverse series very much shorter than those on other segments and connected with three longitudinal series, one in center and one at each extremity which extend midway to posterior spiracles, the latter small, blackish, but little elevated, separated by over twice the width of either; anal opening small, situated some distance from apex.

Length, 8 mm.

*Type*.—Hagerstown, Maryland, June 24, 1916, reared from tipulid pupa, Acc. no. 14022 (H. L. Parker), [U. S. N. M.].

*Allotype*.—Halfway House, Mt. Washington, New Hampshire, July 6, 1914, (C. W. Johnson).

*Paratypes*, males; Melrose Highlands, Massachusetts, May 21, 1916; Raynham, Massachusetts, April 29, 1916, (F. X. Williams); Lunnenburg, Massachusetts, May 21, 1916, (S. M. Dohanian).

**Phaonia pallidula** Coquillett

*Phaonia pallidula* Coquillett, Proc. U. S. Nat. Mus., xxv, p. 122.
*Phaonia dulcis* Stein, Arch. für Naturges., abt. A. 1918, heft 9, p. 5, 1920.

Male.—Black, subopaque. Head black, cheeks brownish, orbits, face, parafacials, and cheeks densely silvery white pruinescent; antennae brownish yellow, third segment infuscated except at base; palpi yellow. Thorax densely gray pruinescent, with four conspicuous brown vittae. Abdomen largely yellowish testaceous, bases of tergites fuscous and with gray pruinescence, each tergite with an elongate central black spot. Legs yellowish testaceous, fore femora except apices, and mid and hind femora each with a broad band beyond middle fuscous; tarsi pale. Wings clear, veins brown, yellow at bases, cross-veins very inconspicuously infuscated. Calyptrae white. Halteres yellow.

Eyes sparsely hairy, separated by distance across posterior ocelli; orbits contiguous above middle, with bristles on anterior half and one or two short

hairs on upper half; parafacial at base of antennae wider than the narrow third antennal segment, narrowed below; cheek about twice as high as widest part of parafacial; longest hairs on arista as long as width of third antennal segment. Thorax without differentiated presutural acrostichals; prealar long; postsutural dorsocentrals three; hypopleura with some weak hairs on upper margin in front of spiracle. Basal sternite bare. Fore tibia with a long median posterior bristle; fore tarsus slender, longer than tibia, basal segment without long outstanding posterior sensory hairs; mid femur with some long bristles on basal half of posteroventral surface; mid tibia with two long posterior bristles; hind femur with some moderately long hairs on basal third of ventral surface, a series of bristles on anteroventral surface which are very short basally and some long bristles on basal half of posteroventral surface; hind tibia with two anteroventral and two anterodorsal bristles; the calcar long, but little beyond middle.

Length, 7. 5 mm.

Redescribed from a male compared with type by Dr. Aldrich, Lakehurst, New Jersey, May 24, (W. T. Davis). Originally described from Georgia. Stein described *dulcis* from Austin, Texas, and Lakehurst, New Jersey.

**Phaonia quieta** Stein

*Phaonia quieta* Stein, Arch. für Naturges., 1918, abt. A, heft 9, p. 14, 1920.

I have identified as this species, which was described from three pairs taken by Dr. Aldrich at Friday Harbor, Washington, a male and female from California. Stein compares it with *erratica* Fallen and *errans* Meigen, so that it is unquestionably correctly placed in my key, and unless there are two very closely allied species here I am fairly confident that my identification is correct. Stein makes no mention of any of the characters I use in my key for separating it from its allies, and I have placed it in three categories to insure its identification should I be incorrect in my surmise.

Length, 8 to 9 mm.

**Phaonia pulvillata** (Stein)

*Aricia pulvillata* Stein, Ann. Mus. Nat. Hungar., II, p. 422, 1904.

This species was not included by Stein in his last paper on North American Anthomyiidae. It is very closely allied to *quieta*, or at least to the species which I have identified as that, having the same habitus and the characters as stated in the key.

It is paler in color, the abdomen in both sexes being largely yellowish testaceous, in the male on basal half, while in *quieta* the general color is black, with the apices or tergites yellowish. Apart from any hypopygial distinctions which may exist, the principal characters for the differentiation of the species are indicated in the key.

Stein's description of *pulvillata* fits my interpretation of *quieta* better in some respects than it does the former, but he specifically mentions the presence of a median posterior bristle on fore tibia in *pulvillata*, and this is present in even the male, whereas in the other species it is absent.

Originally described from Carolina. I have before me one male, Plummer's Island, Maryland, June 22, 1909, (W. L. McAtee); one female, same locality, June 14, 1908, (A. K. Fisher); one female, same locality, July 24, (N. Banks); one female, Delaware Water Gap, New Jersey, July 12, 1895, (C. W. Johnson?).

**Phaonia rufibasis** Malloch

*Phaonia rufibasis* Malloch, Proc. Biol. Soc., Wash., xxxii, p. 207, 1919.

This species is very similar to *errans* Meigen in color, differing in having the basal two antennal segments and base of third as well as the palpi reddish yellow. The coxae are largely, and the femora and tibia entirely reddish yellow.

Structurally similar to *errans* but the parafacials narrower, third antennal segment over twice as long as second. Basal abdominal sternite hairy. Hind femur with a series of anteroventral bristles and one or two rather long bristles at or near middle on posteroventral surface.

Length, 8 to 9 mm.

Originally described from Chester, Massachusetts, August 3, 1911. Type in collection of Boston Society of Natural History.

I have seen one male from Plummer's Island, Maryland, May 27, 1915, (R. C. Shannon), which is in the National Museum Collection.

**Phaonia perfida** Stein

*Phaonia perfida* Stein, Archiv für Naturges., 1918, abt., A, heft 9, p. 13, 1920.

I have not seen this species, which Stein described from one specimen without data, sent to him by Dr. Hough.

It seems extremely probable that the species is closely related to those with which I have associated it in the key, but only an examination of the type specimen will definitely decide that point.

**Phaonia aurea** new species

Female.—Reddish yellow, subopaque. Frons, parafacials anteriorly, third antennal segment, and palpi fuscous; occiput gray pruinescent. Thorax gray pruinescent, the dorsum with four reddish vittae. Abdomen with golden pollinosity, dorsum checkered, the yellow parts changing according to position from which the surface is viewed. Legs rufous yellow, tarsi fuscous. Wings slightly yellowish, cross-veins narrowly infuscated. Calyptrae and halteres yellow.

Frons at vertex one-third of the head-width, widened anteriorly; orbits narrow, each with about six bristles and a series of hairs laterad of them; eyes hairy; parafacial at base of antennae wider than width of third antennal segment, not much narrowed below; cheek about 1.5 as high as widest part of parafacial; third antennal segment twice as long as second; arista long plumose; palpi normal. Thoracic chaetotaxy as in *errans*. Basal abdominal sternite hairy. Fore tibia without a median posterior bristle; mid femur with four or five bristles on basal half of posteroventral surface; mid tibia with three or four posterior bristles; hind femur with a series of long bristles on anteroventral surface, the posteroventral surface bare; hind tibia with three or four anterodorsal and anteroventral bristles. Outer cross-vein curved; fourth vein straight at apex.

Length, 11 mm.

*Type*.—Washington State, (Coll. Coquillett), [U. S. N. M.].

**Phaonia nigricans** Johannsen

*Phaonia nigricans* Johannsen, Trans. Amer. Ent. Soc., XLII, p. 395, 1916.
*Phaonia cayugae* Johannsen, Ent. News, XXVIII, p. 327, 1917.
*Phaonia nervosa* Stein, Arch. für Naturges., abt. A, 1918, heft 9, p. 12 1920.

Stein redescribed this species from material sent to him from Ithaca, New York, the type locality of Johannsen's species.

Johannsen proposed the species name *cayugae* to replace the name *nigricans*, which has been used in the genus *Helina* (=*Mydaea* Stein), but such course is not necessary as the name has not previously been used in the genus *Phaonia*.

The species is very closely allied to *errans* but differs very much in color, the legs being usually entirely black, sometimes with the hind tibiae reddish brown. This is the only means by which the species may be separated, as in size and chaetotaxy they are to all appearances identical. The frons in the females

of *errans*, *varipes*, and *nigricans* has always some hairs on the sides of the interfrontalia.

I have seen this species from Ohio, Montana, Massachusetts, and Wisconsin, and have no doubt that it is widely distributed in the northeastern States.

**Phaonia errans** Meigen

*Anthomyia errans* Meigen, Syst. Beschr., v, p. 86, 1826.

Male.—Black, slightly shining, densely gray pruinescent. Interfrontalia opaque black except when seen from in front; orbits, parafacials, and cheeks with whitish tomentum or pile; face yellowish gray pruinescent; antennae and palpi black. Dorsum of thorax with four black vittae; scutellum largely reddish yellow apically. Abdomen with an interrupted dorsocentral vitta and lateral checkerings black; fifth sternite reddish yellow apically. Legs rufous yellow, fore femora except apices, sometimes the bases of mid femora, and all of tarsi fuscous. Wings sybhyaline, cross-veins slightly infuscated. Calyptrae yellowish white. Halteres yellow.

Eyes hairy, separated at narrowest part of frons by a distance less than width of third antennal segment; orbits narrow, bristles on anterior half and finely haired on posterior half almost to anterior ocellus; interfrontalia distinct on entire length; parafacials a little wider than third antennal segment, but little narrowed below; cheek twice as high as widest part of parafacial, with bristly hairs on lower half and some setulose hairs above vibrissae; third antennal segment twice as long as second; arista plumose. Thorax without presutural acrostichal bristles; postsutural dorsocentrals four; prealar very long; many hairs adjacent to notopleurals; hypopleura with some fine hairs on upper margin in front of spiracle. Basal abdominal sternite hairy, fifth deeply cleft. Fore tibia unarmed at middle; mid femur with about half a dozen bristles on basal half of posteroventral surface, the fine hairs rather long; mid tibia with two or three posterior bristles; mid tarsus with the short spines on anteroventral and posteroventral margins of segments two to four confined to apical halves; hind femur with a series of anteroventral bristles, and usually one or two short bristles on middle of posteroventral surface; hind tibia with two anterodorsal and three or four anteroventral bristles. Outer cross-vein much curved.

Female.—Similar to the male in color, but the fore femora are less conspicuously blackened.

Eyes hairy, separated by about one-third of the head-width; interfrontalia with some erect hairs on each side above. In other respects as male.

Length, 8 to 9.5 mm.

Described from several males and one female received from Scotland and Finland. Stein has recorded the species from Sandusky, Ohio. I have before me a pair taken at Sandusky, Ohio, which are evidently from the same lot as Stein's specimens,

as both were taken by Professor Hine. A female with the label, "Algonquin Park," evidently belongs here.

**Phaonia errans** variety **completa** new variety

Male.—Differs from true *errans* in having all the femora and tibiae rufous yellow, and the short spines on anteroventral and posteroventral margins of the intermediate segments of mid tarsi continued to bases of segments. There is also only one pair of praescutellar acrostichals present.

Length, 8 mm.

*Type*.—Base Station, Mt. Washington, New Hampshire, August 15, 1916, (C. W. Johnson), [Boston Society of Natural History].

**Phaonia errans** variety **varipes** Coquillett

*Hyetodesia varipes* Coquillett, Proc. Wash. Acad. Sci., II, p. 441, 1902.

This form differs from true *errans* only in having the femora more extensively darkened, the fore and mid pairs in male being almost entirely infuscated. There are neither chaetotaxic nor structural distinctions which warrant its separation from true *errans*, and it is in my opinion merely a variety of that species.

I have examined a male and female paratype sent to me from the National Museum Collection by Dr. Aldrich, and have also seen a male from Kuskokwim Valley, Alaska.

**Phaonia deleta** Stein

*Aricia deleta* Stein, Berl. Ent. Zeitschr., 1897, p. 178, 1897.

Male and female.—Black, slightly shining, densely gray, pruinescent. Anterior margin of frons, parafacial, and a large part of cheeks, antennae, except apical two-thirds of third segment, and palpi reddish yellow. Thorax with four fuscous vittae. Abdomen with an elongate blackish spot on middle of each tergite; fourth tergite in both sexes conspicuously yellowish testaceous at apex; fifth sternite in male partly yellowish. Legs testaceous yellow; coxae anteriorly, fore femora on posterodorsal surface, and the tarsi more or less conspicuously, infuscated. Wings hyaline, veins brown, yellowish basally, cross-veins slightly clouded. Calyptrae whitish yellow. Halteres yellow.

Male.—Eyes sparsely hairy; frons at narrowest part distinctly wider than width across posterior ocelli; orbits with setulose hairs from base of antennae to anterior ocellus, the upper setulae weak and short; interfrontalia entire; parafacials at base of antennae a little wider than third antennal segment, not narrowed below; cheek twice as high as width of parafacial, with some long bristles along lower margin and a single series above them which are strong and upwardly curved anteriorly; third antennal segment narrow, ending considerably short of the mouth-margin, about 1.75 as long as second; longest hairs on arista much longer than width of third antennal segment; palpi not

dilated. Thorax without strong presutural acrostichal bristles; postsutural dorsocentrals four; prealar very long; hypopleura hairy on upper margin in front of spiracle. Abdomen ovate, basal sternite bare, fifth with a deep, slightly rounded posterior excision. Fore tibia with a median posterior bristle; fore tarsus longer than tibia, the basal segment without long sensory hairs along posterior surface; mid femur with two or three bristles on basal third of posteroventral surface; mid tibia with four or five posterior bristles and usually one longer bristle on middle of posteroventral surface; hind femur with a number of long bristles on basal third of posteroventral surface; mid tibia with four or five posterior bristles and usually one longer bristle on middle or posteroventral surface; hind femur with a number of long bristles on apical half of anteroventral surface and some short stout spines or bristles in a single or double series on apical half of posteroventral; hind tibia with about four anterodorsal bristles, the anteroventral surface with about four weak setulae, which are not much stronger than the erect series on the anterior and posterior surfaces, basad of the calcar there are usually from one to three additional bristles on the same surface (fig. 24). Outer cross-vein curved.

Female.—Differs from the male in having the eyes almost bare, separated by fully one-third of the head width, the fore tibia usually with an anterodorsal and an extra posterior bristle, the hind femur with the short posteroventral bristles and the hind tibia with the erect anterior setulae and posterior hairs absent.

Length, 7 to 8 mm.

Originally described from Illinois and Pennsylvania. I have seen most of the material that Stein used in describing the species and in addition have examined specimens from Buffalo, Lancaster, Niagara Falls, and Hamburg, New York, and Quebec and Ontario, Canada.

**Phaonia soccata** (Walker)

*Anthomyia soccata* Walker, List. Ins. Brit. Mus., pt. 4, p. 941, 1849.

This species has a similar coloration to that of *serva* Fallen and its allies, but the legs are reddish yellow except the tarsi. The thorax is not distinctly vittate, and the abdomen is marked as in *serva*.

The eyes of the male are rather long haired and widely separated, the narrowest part of frons being about one-fifth of the head-width; the orbits are bristled to a little above the level of the anterior ocellus; parafacial as wide as third antennal segment, not narrowed below; longest hairs on arista barely as long as width of third antennal segment. Thorax without strong presutural acrostichals; prealar very long; postsutural dorsocentrals four; hypopleura hairy on upper margin in front

of spiracle. Basal abdominal sternite bare, fifth with a very broad rounded posterior excision. Fore tibia with one or two median posterior bristles; fore tarsi slender, without long sensory hairs along the posterior side of basal segment; mid tibia with three or four posterior bristles; hind femur without exceptional armature, hind tibia with a bristle near base on posterodorsal surface, the apical posterodorsal bristle barely distinguishable.

Length, 7.5 mm.

I have seen this species only from New York.

**Phaonia frenata** (Holmgren)

*Aricia frenata* Holmgren, Ins. Nordgroenl., p. 103, 1872.

I have seen this species only from Alaska. The summary of the characters of the male given in the key to species should enable students to recognize that sex. I have not seen the female.

Length, 6 mm.

Originally described from Greenland.

**Phaonia alticola** new species

Female.—Black, shining, with distinct but not very dense bluish gray pruinescence. Head entirely black. Thorax quadrivittate. Abdomen with a poorly defined dorsocentral vitta and lateral checkerings black. Legs black. Wings clear, cross-veins not infuscated. Calyptrae yellowish. Halteres dark brown.

Eyes with short hairs; frons about two-fifths of the head-width; orbits strongly bristled, with two series of bristles on upper half and many lateral setulose hairs below; parafacial at base of antennae wider than third antennal segment, not narrowed below; cheek about twice as high as width of parafacial, with a series of bristles on lower margin and some hairs above them; antennae short, third segment not twice as long as second; arista with very short pubescence; palpi slender. Thorax without strong presutural acrostichals; postsutural dorsocentrals three; prealar long; hypopleura bare; sternopleurals 1 : 2. Basal abdominal sternite bare, genitalia normal. Fore tibia with two posterior median bristles; fore tarsus slender, longer than tibia, basal segment without long sensory hairs and not densely haired; mid femur with one or two bristles on basal half of anteroventral surface and five or six on basal half of posteroventral; mid tibia with two anterodorsal and three posterior bristles; hind femur with a series of long bristles on anteroventral surface, and a few on basal half of posteroventral; hind tibia with three or four anteroventral and two anterodorsal bristles, the apical posterodorsal bristle very small. Costal thorn long; last section of fourth vein about as long as preceding section.

Length, 9 mm

*Type*.—North East Truchas Peak, New Mexico, above timber line, August 2, (W. P. Cockerell), [U. S. N. M.].

A rather aberrant species. The orbital bristling shows an approach to that of the genus *Dendrophaonia*, but the cheeks, thorax, and legs are bristled differently from those of the species of that genus.

**Phaonia azygos** new species

Male and female.—Black, subopaque, densely pale gray pruinescent. Thorax with two faint fuscous vittae anteriorly which do not extend beyond middle of dorsum. Abdomen with one elongate black spot in middle of each tergite, which form an almost uninterrupted vitta, the spot on fourth tergite very faint. Legs black, the knees slightly reddish in female. Wings slightly grayish, the cross-veins faintly browned. Calyptrae white. Halteres yellow.

Male.—Eyes very faintly hairy; frons on upper half very narrow, consisting of the whitish contiguous orbits, the setulae confined to anterior half; parafacials almost linear; cheek twice as high as width of third antennal segment, sparsely bristled on lower margin, two or three of the bristles upcurved; arista plumose; third antennal segment three times as long as wide. Presutural acrostichal bristles absent, the hairs fine, in about four series; postsutural dorsocentrals three; prealar long; sternopleurals one to two; no hairs near notopleurals. Abdomen ovate; basal sternite bare. Fore tibia without a median posterior bristle; fore tarsus slender, longer than tibia, without erect sensory hairs along sides of basal segment; mid femur with a complete series of fine bristles on posteroventral surface which become shorter apically; mid tibia with two posterior bristles; hind femur with a complete series of anteroventral bristles which become longer apically, and some shorter bristles on apical half or less of posteroventral surface; hind tibia with one anterodorsal and two anteroventral bristles, the calcar short, about one-fifth from apex, apical anterodorsal and anterior bristles subequal, apical posterodorsal absent. Outer cross-vein almost straight; veins three and four divergent at extreme apices.

Female.—Frons normal; hind femur with three or four anteroventral bristles on apical third.

Length, 5 mm.

*Type*.—Male; Black Mountain, Lake George, New York, September 4, 1920: *allotype*, female; Thatcher Park, Heldeberg Mountains, Albany, New York, May 27, 1920, (H. C. Huckett), [Amer. Entom. Soc.].

This species runs to *nigrocincta* Stein in Stein's key, but that species does not occur in North America.

**Phaonia citreibasis** Malloch

*Phaonia citreibasis* Malloch, Ohio Jour. Science, xx, p. 268, 1920.

This species is glossy black with slight grayish pruinescence on thorax and abdomen, the thorax quadrivittate and the abdomen with a poorly defined dorsocentral vitta. Legs black. Bases of wings, calyptrae, and halteres bright orange.

Eyes sparsely hairy, separated by about the distance across posterior ocelli; arista pubescent. Thorax with two pairs of long fine presutural acrostichals and four pairs of postsutural dorsocentrals; prealar very long. Fore tibia without a median posterior bristle; hind tibia with two to four anteroventral and two anterodorsal bristles.

Length, 8 mm.

Originally described from Alaska.

**Phaonia atrocitrea** new species

Female.—Shining black, almost glossy, with slight but distinct grayish pruinescence on thorax and abdomen. Arista entirely black. Thorax quadrivittate. Abdomen with faint checkerings. Legs black. Wings yellowish at bases, cross-veins narrowly infuscated. Calyptrae orange yellow. Halteres with black knobs.

Eyes with very short hairs; frons about one-third of the head-width; orbits with strong bristles and lateral setulose hairs; parafacial at base of antennae wider than third antennal segment, narrowed below; cheek a little higher than widest part of parafacials, with a series of marginal bristles; third antennal segment not twice as long as second; arista with short pubescence; palpi slightly dilated. Thorax without strong presutural acrostichals; postsutural dorsocentrals four; prealar long; hypopleura with some hairs in middle below spiracle; sternopleurals one to two. Basal abdominal sternite bare. Fore tibia with one or two median posterior bristles; fore tarsus slender, a little longer than tibia, basal segment without long sensory hairs, not densely haired; mid femur with an anteroventral and a posteroventral series of bristles which are rather short; mid tibia with two or three posterior bristles; hind femur with anteroventral series of long bristles and a posteroventral series which does not extend to apex; hind tibia with two anterodorsal and three anteroventral bristles, the apical posterodorsal bristle minute, the others long.

Length, 8 mm.

*Type*.—Savonoski, Naknek Lake, Alaska, July, 1919, (J. S. Hine), [Ohio State University].

This species bears a very strong resemblance to *citreibasis*, but in that species the arista is yellow at base, the wings are much brighter yellow at bases, the halteres are orange yellow, and the hypopleura is bare.

**Phaonia dissimilis** new species

Male.—Shining black, with rather dense bluish gray pruinescence. Head black, interfrontalia opaque, orbits, parafacials, and cheeks with silky white pruinescence. Thorax distinctly quadrivittate. Abdomen with a black dorsocentral vitta and lateral checkerings. Legs black. Wings clear, veins black, cross-veins faintly darkened. Calyptrae white, the outer margin of the lower one fuscous, much darker than the field. Halteres brown.

Eyes rather long haired, separated at narrowest part of frons by about the width of third antennal segment; orbits not contiguous, setulose almost to anterior ocellus; parafacial at base of antennae about as wide as third antennal segment, slightly narrowed below; cheek twice as high as widest part of parafacial, with some fine bristles on margin and above them two series of fine hairs; third antennal segment about twice as long as second; arista with its longest hairs a little longer than its basal diameter. Thorax without strong presutural acrostichals; postsutural dorsocentrals four; prealar long; no hairs adjacent to notopleural bristles; hypopleura bare. Abdomen ovate. Basal sternite bare, fifth with a broad moderately deep posterior excision. Fore tibia without a median posterior bristle, the hairs on that surface longer than usual, forming a series of suberect setulae from base to apex; fore tarsus slender, longer than tibia, the basal segment with the posterior sensory hairs of moderate length; mid femur with rather long hairs on ventral surfaces, those on basal half of posteroventral surface stronger than the others; mid tibia with three posterior bristles, the short hairs longer than usual, especially on posteroventral and posterodorsal surfaces, those on latter forming a series of setulae on its entire length; hind femur similar to mid pair but with a series of bristles on apical half of anteroventral surface; hind tibia with two anterodorsal and two or three anteroventral bristles, the surface hairs on posterior and anterodorsal surfaces setulose.

Length, 7.5 mm.

*Type*.—Savonoski, Naknek Lake, Alaska, July, 1919, (J. S. Hine), [Ohio State University].

**Phaonia imitatrix** Malloch

*Phaonia imitatrix* Malloch, Rep. Can. Arctic Exped. 1913–18, III, Insects, pt. C, Diptera, p. 61c, 1919.

Male.—Glossy black, almost without pruinescence except on orbits, parafacials, face and cheeks. Legs black. Wings clear, fuscous at bases, veins black. Calyptrae white. Halteres black

Eyes almost bare; frons at least twice as wide as distance across posterior ocelli; orbits narrow, rather strongly bristled up to anterior ocellus; parafacial at base of antennae as wide as third antennal segment, not narrowed below; vibrissal angle produced; cheek over one-third as high as eye; arista almost bare. Thorax with four pairs of postsutural dorsocentrals; prealar almost as long as the bristle behind it. Abdomen subcylindrical, slightly tapered apically; basal sternite bare, fifth with an undulated posterior emargination.

Mid tibia with two posterior bristles; hind tibia with two or three anterodorsal and four or five anteroventral bristles. Third wing-vein ending before tip of wing, the wing rounded at apex.

Length, 7 mm.

Originally described from Bernard Harbour, North West Territory, Canada.

**Phaonia fuscisquama** Van der Wulp

*Phorbia fuscisquama* Van der Wulp, Biol. Cent.-Amer., Diptera, 1, p. 340, 1886.

Male.—Deep black, shining, with brownish gray pruinescence which is most dense on dorsum of abdomen. Thorax not vittate. Abdomen with a series of elongate black dorsocentral spots forming an interrupted vitta. Legs black. Wings slightly infuscated, veins black. Calyptrae fuscous. Knobs of halteres yellow.

Eyes bare, separated by not more than width of anterior ocellus; parafacial at base of antennae narrower than third antennal segment; becoming linear below; cheek about as high as width of third antennal segment, profile as in figure 10; arista with very short pubescence. Thorax with the presutural acrostichals long, but not in differentiated pairs; prealar very short; postsutural dorsocentrals four; sternopleurals 1 : 1; basal pair of scutellars much shorter than apical pair. Abdomen narrowly ovate, basal sternite bare. Fore tibia unarmed at middle, shorter than fore tarsus; mid femur without strong ventral bristles; mid tibia with a posterodorsal bristle about one-third from apex; hind tibia with one anterodorsal and one anteroventral bristle. Auxiliary vein approaching costa much more gradually than in the other species, first posterior cell narrowed apically.

Length, 5 mm.

Described from a paratype supplied by the British Museum, from Omilteme, Guerrero, Mexico, (H. H. Smith).

This species has the habitus of a *Hydrotaea* and similar wing venation, but the fore femora are not excavated and armed with a spine on ventral surface before apex as in that genus.

**Phaonia morrisoni** new species

Male.—Similar to the preceding species in color. Differs from it in having the calyptrae yellow, and the abdomen gray pruinescent and with an indistinct dorsocentral vitta.

Eyes pubescent; profile similar to that of preceding species. The chaetotaxy of the thorax is as in that species, as is the bristling of the legs except the hind femora. In addition to the distinction mentioned in the key the type has no bristle on the anteroventral surface of hind tibia, but in the paratype there is a bristle on that surface on one tibia. The first posterior wing cell is not narrowed at apex.

Length, 4 to 5 mm.

*Type.*—White Mountains, New Hampshire, (Morrison), [U. S. N. M.]. *Paratype.*—Killington Park, Vermont, August 23, 1898, [Bost. Soc. Nat. Hist.].

**Phaonia minima** Malloch

*Phaonia minima* Malloch, Rep. Can. Arctic Expel. 1913–18, III, pt. C, Insects, Diptera, p. 61c, 1919.

This species is very similar to the preceding, but differs in having no short stout outstanding bristle on posteriordorsal surface near apex, as stated in key.

Length, 4 to 5 mm.

In addition to the type and allotype specimens from Nome, Alaska, which, I have before me, I have seen one male from St. Paul Island, Alaska, August, 1910, collected by H. Heath, which belongs to the Leland Stanford University collection.

I have seen one female which was taken in Montana that is referable to either this or the preceding species, but it is not possible to definitely decide its identity.

**Phaonia albocalyptrata** Malloch

*Phaonia albocalyptrata* Malloch, Ohio Jour. Science, XX, p. 267, 1920.

This species has a coloration similar to that of *dissimilis*, but the abdomen has no distinct lateral checkerings and the calyptrae are both white.

The eyes are sparsely hairy, the frons at narrowest part is twice as wide as third antennal segment, the orbits have long setulose hairs to level of anterior ocellus, the parafacials are as wide as the third antennal segment and nearly as wide as height of cheek, the arista is short pubescent. Thorax with two or three pairs of long fine presutural acrostichals; prealar long. Basal abdominal sternite hairy. Apical posterodorsal bristle on hind tibia weak and small; hairs on tibia not as long as in *dissimilis*.

Length, 7 mm.

Originally described from Savonoski, Naknek Lake, Alaska. Type in collection of Ohio State University.

**Phaonia marylandica** new species

Male.—Black, shining, gray pruinescent. Orbits, parafacials, face and cheeks silvery white; antennae and palpi yellow, third segment of former brownish. Thorax with four black vittae; scutellum black; humeri slightly yellowish. Abdomen in type missing. Legs entirely yellow. Wings clear, cross-veins not infuscated. Calyptrae and halteres yellowish.

Eyes almost nude, separated at narrowest part of frons by not more than width of third antennal segment; orbits setulose to above middle, contiguous for some distance centrally; parafacial almost linear; longest hairs on arista longer than width of third antennal segment. Thorax with one long and two short pairs of presutural acrostichal bristles; postsutural dorsocentrals four; prealar long; hypopleura bare. Fore tibia unarmed at middle; fore tarsus slender, basal segment with some long outstanding sensory hairs on posteroventral margin; mid femur with some fine bristles on basal half of posteroventral surface; mid tibia with two or three posterior bristles; hind femur with some bristles on apical half of anteroventral surface, the posteroventral surface without bristles except at extreme base and apex; hind tibia with two anteroventral and two anterodorsal bristles.

Length, 8 mm.?

*Type*.—Plummer's Island, Maryland, May 16, 1902, (R. P. Currie), [U. S. N. M.].

**Phaonia harti** new species

Male and female.—Black, shining, densely gray pruinescent. Head with silvery white on orbits, lunule, and especially on parafacials; interfrontalia velvety black except when seen from in front; antennae black; second segment partly reddish yellow; palpi reddish yellow, sometimes infuscated apically. Thorax conspicuously quadrivittate. Abdomen with a black dorsocentral vitta. Legs black, sometimes with only the knees conspicuously reddish yellow, but the tibiae are always paler than the femora and are sometimes obscurely reddish yellow. Wings clear, veins brown, paler basally, the cross-veins not noticeably infuscated. Calyptrae white. Halteres yellow.

Male.—Eyes with very short sparse hairs; narrowest part of frons usually distinctly wider than distance across posterior ocelli; interfrontalia complete; orbits with rather strong bristles from base of antennae to a short distance from anterior ocellus; profile as in figure 11; longest hairs on arista as long as width of third antennal segment; palpi dilated, with short stubby black bristles except basally. Thorax with two pairs of presutural acrostichal bristles; prealar over half as long as the bristle behind it; postsutural dorsocentrals four; hypopleura with a few hairs on middle below spiracle. Abdomen elongate ovate, tapered apically; basal sternite bare, fifth with a broad shallow rounded posterior emargination. Fore tibia without a median posterior bristle; fore tarsus with the sensory hairs on posteroventral margin of basal segment of moderate length; mid femur with some rather irregular and not very long bristles on basal half of posteroventral surface; mid tibia with two or three posterior bristles; hind femur with eight or nine bristles on apical half of anteroventral surface, and four or five on basal half of posteroventral; hind tibia with two or three anteroventral and anterodorsal bristles. Outer cross-vein much bent in middle.

Female.—Frons one-third of the head-width at vertex, widened anteriorly; orbits narrow, the bristles strong, some hairs laterad of them anteriorly; interfrontalia bare. Fourth abdominal tergite distinctly longer than third, the apical bristles weak.

Length, 7 to 8 mm.

Puparium.—Glossy dark red. Almost cylindrical, slightly tapered at each end, surface smooth except narrowly at incisions between segments, where there are many close fine striae, the ventral surface with microscopic striae on the greater part of surface; a rather broad band of microscopic points on anterior margin of each ventral segment which tapers to a point on each side. Anterior respiratory organs small, pale, with six branches which are visible only under a high power lens and are arranged vertically; metathoracic spiracles elevated, slender, each about three times as long as its diameter, slightly curved and tapered apically; anal respiratory discs sessile, the inner part with the slits elevated slightly above the disc, the slits small, radiating, distance between bases of discs equal to 1.5 times the diameter of one disc; apex of abdomen with some irregularly arranged sharp ridges, two of which surround the spiracular discs laterally, but at a considerable distance from them, the other ridges connected with this circular one and extending from it longitudinally or diagonally; area surrounding anal opening granulose, with some fine striae on outer margins.

Length, 8 to 9 mm.

*Type*, *allotype*, and *paratypes*.—Urbana, Illinois, March-April, 1916, reared, (J. R. Malloch). *Paratypes*, ten specimens, same locality, May 28, 1890, (C. A. Hart); one specimen, Dyke, Virginia, July 10, 1916; one specimen, Great Falls, Virginia, May 2, 1917; one specimen, Potlach, Idaho, September 9, 1912; one specimen, Lacombe, Canada. Type in collection of Illinois Natural History Survey.

The above puparium description was made from puparia of the type series. The larvae are predaceous and live under the bark of freshly fallen trees and slightly loosened bark of trees still standing. They can subsist on the sap which is present where they occur, but so readily attack other larvae that they may be classed as really predaceous.

The larvae that I have found along with them at Urbana, Illinois belong to the following species or families. *Lonchaea polita* Say, *L. laticornis* Zetterstedt, Pachygastrinae, and Ortalidae. With the exception of the Pachygastrinae the others are predaceous.

**Phaonia striata** (Stein)

*Aricia striata* Stein, Berl. Ent. Zeitschr., 1897, p. 179, 1897.

Male.—Black slightly shining, densely brownish gray pruinescent. Antennae black, second segment reddish; palpi fuscous, reddish basally. Thoracic dorsum quadrivittate; scutellum yellowish apically. Abdomen with a poorly defined but distinct dorsocentral black vitta, and, when seen from certain angles, with lateral blackish checkerings. Legs yellowish testaceous,

coxae, fore femora except their apices, basal half of mid femora, and bases of hind femora infuscated, tarsi black. Wings hyaline, cross-veins not infuscated. Calyptrae and halteres yellowish.

Eyes densely long haired; narrowest part of frons as wide as distance between posterior ocelli; orbits with fine bristles and hairs from base of antennae to anterior ocellus, those above middle short and weak; parafacial at base of antennae much narrower than third antennal segment, not narrowed below; cheek about twice as high as width of third antennal segment, with about five series of fine bristles on lower third, the upper two or three series weak, upwardly curved anteriorly (fig. 12); third antennal segment fully twice as long as second; longest hairs on arista distinctly shorter than width of third antennal segment; palpi barely widened apically. Thorax with two pairs of presutural acrostichals; prealar at least half as long as the bristle behind it; postsutural dorsocentrals four; hypopleura with a few fine hairs below spiracle. Abdomen broadly ovate; basal sternite bare, fifth with a very broad shallow posterior emargination, appearing almost transverse. Fore tibia without a median posterior bristle; fore tarsus distinctly longer than tibia, basal segment with the sensory hairs on posterioventral margin very short, only the one at apex long; mid femur with some bristles on basal half of posteroventral surface, those at middle longest; mid tibia with three posterior bristles; hind femur with a series of closely placed, moderately long bristles on entire anteroventral surface, and some much finer bristles on basal half of posteroventral surface; hind tibia with three or four anteroventral and two or three anterodorsal bristles.

Length, 7.5 mm.

Redescribed from the specimen in the Hough collection which is assumably the type. Locality, Moscow, Idaho.

The allotype is not in the collection. Stein states in his original description that the female has the femora entirely yellow and the interfrontalia with a pair of cruciate bristles.

**Phaonia uniseriata** new species

Female.—Black, slightly shining, densely gray pruinescent. Interfrontalia opaque brownish black when seen from above, the remainder of head except eyes with brownish gray pruinescence; antennae and palpi entirely black. Thorax indistinctly quadrivittate. Abdomen with a poorly defined dorsocentral vitta and lateral checkerings black. Legs black, extreme apices of femora and at least the hind tibiae reddish. Wings slightly brownish, veins brown, paler basally, cross veins slightly infuscated. Calyptrae and halteres obscurely yellowish.

Eyes with moderately long and dense hairs; frons one-third of the head-width of vertex, widened anteriorly; interfrontalia bare; orbits narrow, each with six or seven bristles and laterad of these numerous setulose hairs; antennae stout, third segment about twice as long as second; longest hairs on arista not longer than its basal diameter; parafacial at base of antennae a little wider than third antennal segment narrowed below; cheek a little higher than

widest part of parafacial, with three or four series of bristles on lower half; palpi distinctly broadened apically, the bristles fine and of average length. Thorax with two or three pairs of long presutural acrostichals which are set very close together, forming almost a single irregular series; postsutural dorsocentrals four; prealar long; hypopleura with some fine hairs below spiracle. Abdomen with the basal sternite bare; fourth tergite distinctly longer than third; apical paired genital processes with short stiff erect hairs. Fore tibia without a median posterior bristle; fore tarsus longer than fore tibia, basal segment without long sensory hairs on posterior side; mid femur with a series of long bristles on basal two-thirds of posteroventral surface and some much shorter bristles on basal half of anteroventral; mid tibia with two or three posterior bristles; hind femur with a series of stout bristles on anteroventral surface and some long hair-like bristles on basal half of posteroventral surface; hind tibia with two or three anterodorsal and three or four anteroventral bristles, calcar long. Outer cross-vein curved.

Length, 7.5 mm.

*Type*.—Pullman, Washington, May 19, 1921, (A. L. Melander), in collection of Dr. A. L. Melander.

This specimen resembles *striata* Stein so closely that I at first thought it might be the female of that species. But Stein has described the female of *striata* as having the legs entirely yellow, and the frons with a pair of cruciate interfrontal bristles, neither of which characters apply to the specimen before me.

**Phaonia brevispina** new species

Male and female.—Black, slightly shining, densely gray pruinescent. Antennae black, basal two segments brownish; palpi fuscous, usually paler at bases. Thorax distinctly quadrivittate; scutellum blackish in center. Abdomen with a more or less distinct dorsocentral vitta and lateral checkerings black. Legs black or dark brown, apices of femora and all of tibiae brownish yellow. Wings clear; cross-veins distinctly infuscated. Calyptrae white. Halteres yellow.

Male.—Eyes almost bare, separated at narrowest part of frons by a distance over twice as great as width across posterior ocelli; orbits with setulae to anterior ocellus; cheek about one-third of the eye height; longest hairs on arista at least as long as width of third antennal segment; palpi but little dilated. Thorax as in *harti*. Mid tibia with two posterior bristles; hind femur with very short stout bristles on anteroventral surface, and in the larger specimens with similar but weaker bristles on posteroventral surface; hind tibia usually with two anterodorsal and two anteroventral bristles. Outer cross-vein very slightly curved.

Female.—Differs from a male in having the palpi noticeably dilated, frons over one-third of the head-width and sometimes with a pair of weak interfrontal cruciate bristles. Fouth abdominal tergite not noticeably longer than third.

Length, 6.5 to 8 mm.

*Type.*—Male; Urbana, Illinois, August 1, 1916, (Malloch), [Illinois Natural History Survey]. *Allotype.*—Female; Same locality, September 5, 1915, at sap exuding from tree trunk, (Malloch). *Paratypes.*—Two males, Glen House, New Hampshire, June 11, 1916; one female, Mount Washington, New Hampshire, June 30, 1913, (C. W. Johnson); two males, Fall Church, Virginia, April 13 and May 3, (N. Banks); one female, Wauseon, Ohio, August 18, 1914, (J. S. Hine); one male, Viento, Oregon, July 1, 1917, (A. L. Melander); two male, Moscow Mountain, Idaho, July 4, 1911, (J. M. Aldrich); one male, Hoqulam, Washington, June 3, 1904, (Burke).

**Phaonia fuscicauda** Malloch

*Phaonia fuscicauda* Malloch, Trans. Amer. Ent. Soc., XLIV, p. 269, 1918.
*Phaonia fuscinervis* Stein, Arch. für Naturges., 1918, abt. A, heft 9, 1920.

Male and female.—Head testaceous yellow, upper half of occiput fuscous gray pruinescent; third antennal segment largely brown; palpi testaceous, yellow. Thorax testaceous yellow, disc of mesonotum, and scutellum, the metanotum, and some poorly defined areas on pleura fuscous. Abdomen testaceous yellow, fuscous at apex, colored with gray pruinescence, and with a brownish or fuscous dorsocentral vitta which is most distinct on basal three tergites. Wings clear, both cross-veins narrowly infuscated. Calyptrae and halteres yellow.

Male.—Eyes sparsely but distinctly haired, separated at narrowest part of frons by little more than width of anterior ocellus; orbits setulose to a little above middle, where they are contiguous; parafacial narrower than third antennal segment; cheek about twice as high as width of third antennal segment; longest hairs on arista longer than width of third antennal segment. Thorax with two pairs of fine presutural acrostichals; postsutural dorsocentrals three; prealar long; hypopleura bare. Basal sternite bare, fifth with a deep central excision. Fore tibia unarmed at middle; mid femur with about six bristles on basal half of posteroventral surface; mid tibia with two or three posterior bristles; hind femur with long bristles on anteroventral surface and short bristles on basal half of posteroventral; hind tibia with two or three anteroventral and anterodorsal bristles; calcar about one-fourth from apex.

Female.—Frons over one-third of the head-width.

Length, 7 to 8 mm.

Originally described from California. I have before me two males and one female from Kamiac Butte, Washington, and one female from Brooklyn, California, Stein described *fuscinervis* from Friday Harbor, Washington.

**Phaonia texensis** new species

Male and female.—Black, subopaque, densely gray pruinescent. Antennae reddish yellow, third segment brownish apically; palpi reddish yellow. Thorax with four fuscous vittae, and posteriorly with a central brown vitta which extends over disc of scutellum. Abdomen with a slightly interrupted dorsocentral fuscous vitta, and a pair of less distinct brown spots on each tergite; apex of fourth tergite rufous yellow. Legs reddish yellow; all femora broadly infuscated basally, tarsi black. Wings clear, both cross-veins conspicuously infuscated, the outer with its extremities more conspicuously so than its central part. Calyptrae white. Halteres yellow.

Male.—Eyes hairy, separated at narrowest part of frons by a distance two or three times as great as width across posterior ocelli; orbits narrow, strongly bristled to anterior ocellus; parafacial at base of antennae at least as wide as third antennal segment; cheek twice as high as widest part of parafacial; setulae continued some distance above vibrissa; third antennal segment about three times as long as second; longest hairs on arista as long as width of third antennal segment; palpi broad. Thorax with three pairs of presutural acrostichals, and four pairs of postsutural dorsocentrals; prealar long; hypopleura with a few fine hairs on upper margin in front of spiracle. Basal abdominal sternite bare, fifth with a deep posterior excision. Fore tibia unarmed at middle; mid femur with bristles on basal half of posteroventral surface; mid tibia with about six unequal sized bristles in a double series on posterior side; hind femur with short bristles on anteroventral surface, which are weak basally and become stout as they near the apex, the posteroventral surface with similar bristles on apical third or more, which is contrary to the general rule in *Phaonia*, where they are almost always on the basal half on this surface; hind tibia with one anteroventral and two anterodorsal bristles and a series of stout setulae on anterior and posterior surfaces Outer cross-vein very conspicuously bent inward at middle.

Female.—Similar to the male but the frons is over one-third of the head-width, and the hind femur has the posteroventral bristles less distinct.

*Type*.—Male, and one male *paratype*, Brownsville, Texas, November, 23, 1910, at sugar, (C. A. Hart). *Allotype* and one male *paratype*, same locality, December 17, 1910, (C. A. Hart). *Paratype*, male, Uvalde, Texas, April 4, 1916, (Bishopp, No. 5670). Type in collection of Illinois Natural History Survey.

**Phaonia texensis** variety **flavofemorata** new variety

Differs from the typical form in having the mid and hind femora or all femora reddish yellow, and the hypopleura bare.

It is possible that this is a distinct species, but my material is insufficient to enable me to decide.

*Type*.—Male, and one male *paratype*, Florida (Maynard). *Allotype*, female, Uvalde, Texas, November 1, 1915. *Paratype*, female, Uvalde, Texas, November 18, 1915, (Bishopp). All in U. S. N. M.

**Phaonia limbinervis** Stein

*Phaonia limbinervis* Stein, Ann. Nat. Mus. Hungary, xvi, p. 208, 1918.

I have before me a male and female, which agree so closely with Stein's description of this species that I can not doubt their identity with it. The species, which very closely resembles *texensis*, differs only as indicated in the key to species.

This species was originally described from Mexico, and afterwards recorded by Stein (1920) from California.

The two specimens I have examined are from Lava, New Mexico, April 11, 1898, (Cockerell), and Tempe, Arizona, March 8, 1914, (Wildermuth).

**Phaonia aberrans** Malloch

*Phaonia aberrans* Malloch, Proc. Biol. Soc. Wash., xxxii, p. 208, 1919.

This species differs from its allies in having an additional strong bristle on the posterodorsal surface of the hind tibia basad of the calcar. The apical posterodorsal bristle is as strong as the dorsal one.

Length, 9 to 10 mm.

Originally described from one male taken by W. L. McAtee at Beltsville, Maryland, I have before me the type and another male, taken at Riverton, New Jersey, April 17, 1905, which belong to the collection of the United States National Museum.

**Phaonia alaskensis** new species

Female.—Black, distinctly shining, head, thorax and abdomen with grayish pruinescence. Frons, when seen from above, velvety blackish brown; frontal lunule silvery white; antennae black, basal two segments yellowish; palpi yellow, broadly infuscated apically. Thorax quadrivittate. Abdomen without distinct markings, with a slight violaceous tinge. Legs including coxae reddish yellow, tarsi fuscous. Wings clear, veins brown, yellow basally. Calyptrae and halteres yellow.

Eyes indistinctly hairy; frons a little over one-third of the head-width; orbits narrow, the bristles irregular, usually two outwardly curved on upper third, some setulose hairs laterad of the bristles; parafacial at base of antennae not as wide as third antennal segment, narrowed below; cheek barely as high as width of third antennal segment, with two or three series of bristles along

lower margin; third antennal segment broad, not twice as long as second, its apex almost at mouth-margin; arista with very short pubescence, the longest hairs not longer than its basal diameter; palpi slightly broadened apically. Thorax with two or three pairs of short setulose presutural acrostichals, between which there are some hairs; postsutural dorsocentrals four; prelar short but distinct; hypopleura bare. Basal tergite bare. Fore tibia with a median posterior bristle; fore tarsus slender, longer than tibia, without long sensory hairs along posterior side of basal segment; mid femur with a fine bristle at base on ventral surface; mid tibia with two posterodorsal and one posterior or posteroventral bristle; hind femur with two or three preapical bristles on anteroventral surface; hind tibia with one anterodorsal and two anteroventral bristles. Last two sections of fourth vein subequal.

Length, 5.5 mm.

*Type* and three *paratypes*.—Muir's Inlet, Alaska, June 12, 1899, (T. Kincaid, Harriman Alaska Expedition). *Paratypes*, one female, Anchorage, Alaska, July 22, 1921; one female, Hurricane, Alaska, July 15 1921, and two females, Camp 297 of Alaska Engineers' Commission, 12 miles north of Hurricane, Alaska, July 14, 1921, (J. M. Aldrich). All in U. S. N. M.

**Phaonia subfusca** new species

Male and female.—Black, subopaque, densely gray pruinescent. Basal two segments of antennae and base of third, palpi, and the lower and anterior part of cheeks reddish yellow. Thorax inconspicuously quadrivittate. Abdomen with a linear black dorsocentral vitta. Legs fuscous, apices of femora and all of tibiae reddish yellow. Wings clear, cross-veins not noticeably infuscated. Calyptrae yellowish white. Halteres yellow.

Male.—Eyes almost bare, separated by a distance about equal to twice the width of third antennal segment; orbits narrow, setulose nearly to anterior ocellus; interfrontalia not interrupted; profile as in figure 16. Thorax with three pairs of postsutural dorsocentrals; prealar very long; hypopleura hairy on upper margin in front of spiracle. Abdomen narrowly ovate, basal sternite bare, fifth with a deep posterior excision. Fore tibia with a posterior median bristle; fore tarsus slender, longer than tibia, without sensory hairs except at apices of segments; mid femur with about four bristles on basal half of posteroventral surface; mid tibia with two or three posterior bristles; hind femur with a series of long strong bristles on apical half of anteroventral surface, and many long setulose hairs on basal half of ventral surfaces; hind tibia with three or four anteroventral setulae, which are weaker than the series of anterior setulae, the anterodorsal surface with from two to five unequal bristles, a weak bristle basad of ealcar and a series of fine erect hairs on middle of posterior surface, the apex with the three dorsal bristles equal (fig. 23). Costal thorn long.

Female.—Differs from the male in having the frons over one-third of the head-width, and the hind femora and tibiae with fewer hairs.

Length, 7.5 to 8 mm.

*Type*.—Male, *allotype*, female, and three male and four female *paratypes*, Pulaski, Illinois, July 2, 1910, taken in a meadow, (C. A. Hart). *Paratypes*, one female, Vinton, Ohio; one female, Columbus, Ohio, (J. S. Hine). All in collection of Illinois Natural History Survey.

**Phaonia nigricauda** Malloch

*Phaonia nigricauda* Malloch, Trans. Amer. Ent. Soc., XLIV, p. 268, 1918.

This species has the eyes of the male more widely separated than does any other of the *apicata* group except *pallida* Stein. The orbits are setulose to anterior ocellus, and the abdomen of the male is narrow and subcylindrical, almost as in *pallida*.

I have seen this species only from California—Berkeley, Santa Cruz, and Redwood Canyon.

**Phaonia flava** Stein

*Phaonia flava* Stein, Arch. für Naturges., 1918, abt. A, heft 9, p. 6, 1920.

This species closely resembles the foregoing in habitus, size, and color, differing most noticeably in the color of the head. Profile of head as in figure 14.

I have no males of *flava* for comparison of this sex with that of *nigricauda*.

Length, 6 mm.

Stein had, I believe, two species confused in his material when he described *flava*, the specimens from California being *nigricauda* and the others, from Washington, what we may justifiably accept as *flava*. I take this view because I do not believe that, if my surmise is correct and he really had two species confused, I am entitled to sink his species as a synonym of *nigricauda* and rename the specimens which are evidently different. It is evident that the description was very largely drawn from a Californian male, but the first locality mentioned is Friday Harbor, Washington, where *nigricauda* so far as I know does not occur.

I have a number of females of *flava*, as here limited, from Washington state: Tacoma, Mount Constitution, Chatcolet, Piedemont, and Friday Harbor; and one from Forest Grove, Oregon.

**Phaonia pallida** (Stein)

*Dialyta pallida* Stein, Arch. für Naturges., abt. A, heft 9, p. 22, 1920.

This species, though having the eyes of the male widely separated and some of the characters and general habitus of a *Dialyta*, is really an aberrant *Phaonia* (fig. 15). Stein recognises the similarity of the species and *flava* in his notes on the former. The genus *Dialyta* is not easily separable from *Phaonia*, but the legs in the former are more strongly bristled, and in both the American species known to me there are bristles on the anterodorsal surfaces of the fore and mid tibiae, and the apical tibial bristles are very long and numerous.

Stein described *pallida* from a male taken at Julietta, Idaho. The similarity between the species would have been more striking to Stein, had he considered the male of *flava*, with wide frons, as normal instead of aberrant. Evidently the frons in the male of *flava* is about as wide as in *pallida*, and but little darker than in the latter species, judging from Stein's remarks under *flava*.

I have specimens of *pallida* from the following localities: two males and one female, Almota, one female, Union Flat, one female, Pullman, one female, North Yakima, all from Washington; one female, Hood River, Oregon; three females, Mono Lake, California. All the above were sent to me by Dr. Aldrich.

**Phaonia flavibasis** Malloch

*Phaonia flavibasis* Malloch, Proc. Biol. Soc. Wash., xxxii, p. 208, 1919.

Since describing this species I have seen another male, from Hanover, New Hampshire.

Structurally the species very closely resembles *bysia* Walker, but the prealar bristle is much shorter and the basal half of the abdomen is conspicuously subpellucid yellow.

There are several species belonging to this same group, all of which are very closely related, *bysia* Walker, *apicata* Johannsen, *apta* Stein and *winnemanae* Malloch.

**Phaonia curvinervis** new species

Female.—Shining black, with distinct gray pruinescence. Antennae and palpi rufous yellow, third segment of former brown except at base. Thorax quadrivittate, margins of humeri, posterolateral margins of mesonotum, scu-

tellum and margins of pleural sclerites yellowish. Abdomen with an indistinct dorsocentral vitta and lateral checkerings black. Legs including coxae yellow, tarsi slightly infuscated. Wings clear, veins basally, and calyptrae and halteres yellow.

Eyes almost bare; frons at vertex about one-third of the head-width; slightly wider anteriorly; orbits narrow, the bristles strong, few hairs adjacent to the bristles; parafacials narrow; cheek about as high as width of third antennal segment; third antennal segment twice as long as second; longest hairs on arista distinctly longer than width of third antennal segment. Thorax without distinct presutural acrostichals; postsutural dorsocentrals three; prealar almost as long as the bristle behind it; anterior intra-alar very strong. Fore tibia with two anterodorsal and two posterior bristles; fore tarsus slender, longer than tibia, basal segment with some rather long sensory hairs along posterior side; mid tibia with four or five bristles of unequal lengths on posterior side in an irregular series; hind femur with a complete series of sparse bristles on anteroventral surface, and some fine bristles on basal half of posteroventral; hind tibia with two anterodorsal and four or five anteroventral bristles, the apical posterodorsal bristle small but distinct. Fourth wing-vein slightly but distinctly curved forward apically (fig. 21).

Length, 8.5 mm.

*Type*.—New London, Connecticut, July 10, 1916, (R. C. Osborn), [Ohio State University].

**Phaonia solitaria** Stein

*Phaonia solitaria* Stein, Arch. für Naturges., 1918, abt. A, heft, 9, p. 15, 1920.

This species, which I have not seen, is closely related to the following two. Johannsen in describing *apicata* placed it in the subgenus *Euphemia*, because some specimens had a more or less distinct pair of presutural acrostichal bristles. Stein separates *solitaria* from the other species which he has keyed by the presence of these bristles, *solitaria* having a pair present and the others lacking them. His specimens of *solitaria* included one from Ithaca, probably sent from Cornell, and as Johannsen described *apicata* from that locality I believe I am right in assuming that *solitaria* is merely a variant of the former.

I have a male sent to me by Dr. Aldrich, and taken at Petersham, Massachusetts, which has, besides a distinct pair of presutural acrostichals, four dorsocentrals at least on one side; the other side is damaged by the pin so that it is impossible to say how many there are. I believe this specimen is merely a variant of *apicata*.

**Phaonia apicata** Johannsen

*Phaonia apicata* Johannsen, Trans. Amer. Ent. Soc., XLII, p. 396, 1916.
*Phaonia pallicornis* Stein, Arch, für Naturges., 1918, abt. A, heft 9, p. 12, 1920.

This species is common in the northeastern United States and extends into Canada. I have grave doubts as to its being distinct from *bysia* Walker.

I have before me specimens from Mt. Equinox, Vermont; Bretton Woods, New Hampshire; New Bedford, Massachusetts; Homestead, Iowa, and Youghall, New Brunswick, Canada.

**Phaonia bysia** Walker

*Anthomyia bysia* Walker, List Dipt. Ins. Brit. Mus., pt. 4, p. 936, 1849.

This species and the last very closely resemble *Mydaea occidentalis* Malloch in habitus and color, and are often confused with it in collections. Lack of sufficient material of this form prevents me from attempting to decide whether or not they are distinct species.

I have seen *bysia* only from North Adams, Massachusetts, and Glen House, New Hampshire, (C. W. Johnson).

**Phaonia winnemanae** Malloch

*Phaonia winnemanae* Malloch, Proc. Biol. Soc. Wash., XXXII, p. 3, 1919.

This species closely resembles *apicata*, but has the humeri, posterior lateral margins of mesonotum and tarsi yellow. The eyes are separated by more than the width across posterior ocelli, the prealar bristle is very long, the hind femora have some weak bristles on the basal half of posteroventral surface, while the hind tibia has two or three anterodorsal, and four or five anteroventral bristles, and four or five long setulae on the anterior surface, as well as some shorter setulae on posterior surface.

Length, 7 mm.

Originally described from Plummer's Island, Maryland.

**Phaonia parviceps** Malloch

*Phaonia parviceps* Malloch, Trans. Amer. Ent. Soc., XLIV, p. 267, 1918.
*Phaonia caesia* Stein, Arch. für Naturges., 1918, abt. A, heft 9, p. 4, 1920.

This species was originally described from one female. I am now able to present the description of the male.

Male.—Similar in color to the female, the dorsocentral vitta on abdomen more distinct.

Eyes very sparsely hairy, separated at narrowest part of frons by a distance equal to width of third antennal segment; orbits contiguous above middle, to which point they are setulose (fig. 13). Abdomen narrowly ovate, basal sternite bare. Fore tibia without a posterior bristle; the anterodorsal setulae small but distinct; fore tarsus slender, without long sensory hairs along the posterior side of basal segment; posteroventral surface of hind femur with short irregular setulose hairs.

*Allotype*, and one male and one female; San Antonio Canyon, Ontario, California, July 25, 1907, (J. S. Hine). One female, Claremont, California, in mountains, (Baker), [U. S. N. M.].

**Phaonia trivialis** new species

Male.—Black, shining. Head conspicuously grayish pruinescent, antennae and palpi black. Thorax quadrivittate, with faint grayish pruinescence. Abdomen densely gray pruinescent, with a poorly defined dorsocentral vitta, which tapers from base to apex and nearly disappears before tip, the bases of the bristles and hairs with a black dot surrounding each. Legs black. Wings clear, infuscated at bases and with a faint infuscation on cross-veins. Calyptrae and halteres yellow.

Eyes hairy; frons rather broad, wider than distance across posterior ocelli; orbits narrow, either about one-third as wide as interfrontalia, bristled on entire length; parafacial at base of antennae not as wide as third antennal segment, narrowed below; face concave in middle; cheek not twice as high as widest part of parafacial, with bristles on lower half; third antennal segment about twice as long as second; longest hairs on arista distinctly shorter than width of third antennal segment. Thorax with two or three pairs of irregularly arranged presutural acrostichals, which are not conspicuously differentiated from the long adjoining hairs; postsutural dorsocentrals three; prealar bristle fine but long. Abdomen short ovate, basal sternite bare, fifth with a broad shallow posterior emargination. Fore tibia without a median posterior bristle; fore tarsus slender, longer than tibia, with a fine sensory hair at base of basal segment and at apices of other segments on anterior and posterior sides; mid femur with a series of weak posteroventral bristles which are longest at middle; mid tibia with one posterior bristle basad of middle; hind femur with the anteroventral bristles almost absent basally, long on apical half, the posteroventral surface with some short bristles on basal half; hind tibia with two anterodorsal and four anteroventral bristles. Outer cross-vein curved; veins three and four distinctly divergent apically.

Length, 5 mm.

*Type*.—Banff, Alberta, Canada, [Illinois State Natural History Survey].

**Phaonia laticornis** new species

Male and female.—Black, distinctly shining, with moderately dense gray pruinescence. Head entirely black, orbits, parafacials, and cheeks with whitish pruinescence. Thorax with four black vittae. Abdomen with a series of poorly defined dorsocentral spots and lateral checkerings black. Legs testaceous yellow, tarsi black, femora darker than tibiae, at least the fore pair and sometimes all pairs infuscated. Wings clear. Calyptrae yellowish white. Halteres yellow.

Male.—Eyes almost bare; narrowest part of frons about one-fifth of the head-width; orbits narrow, each with about seven long bristles, the upper one opposite anterior ocellus, and in addition to the bristles numerous setulose hairs; third antennal segment about three times as long as broad, extending almost to mouth-margin; arista with its longest hairs about twice as long as its basal diameter; parafacial over half as wide at base of antennae as width of third antennal segment, becoming almost linear below; cheek nearly as high as width of third antennal segment. Thorax with the presutural acrostichal hairs long but not setulose; prealar long; postsutural dorsocentrals three; hypopleura bare. Abdomen ovate, basal sternite bare, fifth cleft. Fore tibia with two posterior bristles; hind femur with some erect hairs at base ventrally and two preapical anteroventral bristles; hind tibia with two anterodorsal and two anteroventral bristles.

Length, 6.5 to 7.5 mm.

(S. A. Shaw), [Illinois State Natural History Survey]. *Allotype*, female, Cedar Lake, Illinois, August 6, 1906, (C. A. Hart). *Paratypes*, females, Oconto, Wisconsin, August 1, 1920, (T. H. Frison); Dummerston, Vermont, July 14, 1908, (C. W. Johnson); Virginia, no other data, [U. S. N. M.].

**Phaonia atlanis** new species

Male.—Black, subopaque, densely gray pruinescent. Orbits, parafacials, and cheeks white pruinescent; basal two antennal segments brownish yellow, third black; palpi fuscous. Thorax with four fuscous vittae on anterior half, the median pair most distinct. Abdomen with a dorsocentral fuscous vitta which is more or less triangularly dilated on each segment. Legs yellow, all femora more or less infuscated, the fore pair most distinctly so, tarsi fuscous; Wings clear, cross-veins narrowly but distinctly infuscated. Calyptrae whitish. Halteres yellow.

Eyes almost bare, separated at narrowest part of frons by a distance about twice as great as width of third antennal segment; orbits with bristles almost to level of anterior ocellus; interfrontalia distinct on its entire length, at its narrowest part wider than one orbit at that part; parafacial not as wide as third antennal segment; cheek higher than width of third antennal segments; longest hairs on arista longer than width of third antennal segment. Thorax with two or three series of fine hairs between the presutural parts of the

submedian vittae; prealar long; postsutural dorsocentrals three. Abdomen narrow, almost subcylindrical, basal sternite bare, fifth with a broad deep posterior excision. Fore tibia with a median posterior bristle; fore tarsus slender, longer than tibia, without long sensory hairs on posterior surface of basal segment; mid femur with one bristle near base on posteroventral surface; mid tibia with two or three posterior bristles; hind femur with some weak bristles on anteroventral surface, only the apical one long; hind tibia with one anterodorsal and one long and one or two short anteroventral bristles and a few short posterior setulae, the calcar at least one-third of the tibial length from apex, all three dorsal apical bristles long (fig. 22).

Length, 5 to 5.5 mm.

*Type*.—Riverton, New Jersey, April 20, (C. W. Johnson), [Boston Society of Natural History]. Two male *paratypes*, Riverton, New Jersey, August 17, (C. W. Johnson), and Falls Church, Virginia, April 23, (N. Banks).

The paratypes have the femora much paler than does the type.

**Phaonia fusca** (Stein)

*Spilogaster fusca* Stein, Berl. ent. Zeitschr., 1897, p. 189.

This species is one of the commonest and one of the most variable of the genus occurring in this country. In most specimens there are one or two weak hairs at base of third wing-vein on the under surface, a character which if invariably present would readily separate it from its allies. There are but few species which possess this character, though *atlanis* does. There are also usually one or two fine hairs adjacent to the base of the posterior notopleural bristle and the bristle at apex of posterodorsal surface of hind tibia is very much weaker than the dorsal and anterodorsal bristles, facts which show its relationship with the *errans* group, rather than with those with which it falls in the key, though like them it has only three pairs of postsutural dorsocentrals. Profile of head as in figure 17.

There are no species known to me from North America with which this species can readily be confused, except those with which it is compared in the key.

I have taken the species commonly on tree-trunks along the margins of woods in Illinois from May to August, and have seen many specimens from other states, including Ohio, Virginia, New York, New Jersey and New Hampshire.

**Phaonia diruta** (Stein)

*Spiligaster diruta* Stein, Berl. ent. Zeitschr., 1897, p. 188.

I have before me, besides the defective type male, several specimens of both sexes of this species. It superficially resembles *fusca*, but is much smaller. The cross-veins of the wings are not noticeably infuscated and the structural differences pointed out in the key to species will serve to distinguish it from its closest allies.

Length, 5 to 6.5 mm.

The type was taken at Manayunk, Pennsylvania. Specimens before me are from Cumberland County, New Jersey and Lafayette, Indiana.

**Phaonia prisca** Stein

*Phaonia prisca* Stein, Arch. für Naturges., 1918, abt. A, heft 9, p. 14, 1920.

Male.—Black, slightly shining, densely gray pruinescent. Orbits, face, cheeks, and parafacials with silvery tomentum; antennae yellow, third segment brownish fuscous; palpi fuscous. Thorax rather indistinctly vittate. Abdomen with a linear dorsocentral black vitta, fifth sternite largely yellowish. Legs entirely yellow, tarsi slightly darkened. Wings hyaline, veins yellow. Calyptrae and halteres yellow.

Eyes almost bare; narrowest part of frons a little wider than distance across posterior ocelli; orbits broad, obscuring the interfrontalia for the greater part of its length, bristles only on the anterior half; parafacial at base of antennae as wide as third antennal segment, slightly narrowed below; cheek a little less than twice as high as widest part of parafacial with a series of rather widely spaced long bristles along the lower margin, some hairs above them posteriorly and two bristles anteriorly which are upwardly curved (fig. 18); third antennal segment about twice as long as second; arista with its longest hairs about as long as width of third antennal segment; palpi normal. Thorax without distinct presutural acrostichals, the hairs sparse; postsutural dorsocentrals three; prealar over half as long as the bristle behind it; hypopleura bare. Abdomen ovate; basal sternite bare. Fore tibia without a median posterior bristle; fore tarsus a little longer than tibia, without long sensory hairs along posterior side of basal segment; mid femur with four or five long bristles on basal half of posteroventral surface; mid tibia with four or five posterior bristles which are not equal in length; hind femur with an almost complete series of anteroventral and posteroventral bristles, those of the latter series weak apically; hind tibia with one anterodorsal and three or four anteroventral bristles, the anterior and posterior surfaces with some erect setulae. Outer cross-vein slightly curved.

Length, 7 mm.

Originally described from one male from Ithaca, New York. I have before me a male from the same locality.

### *List of Stein Species Unknown to Author*

The types of the following species will finally be deposited in the United States National Museum, but they have not yet been delivered to its care, so that it is impossible to authentically identify them.

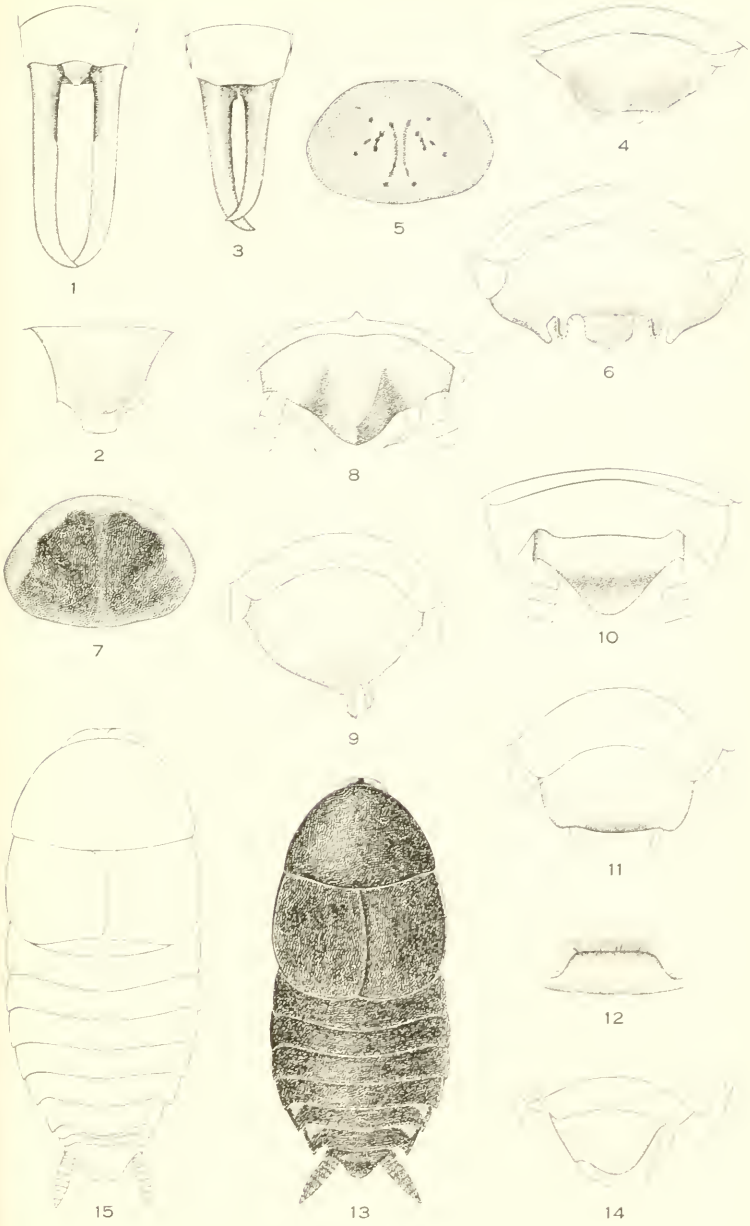
*apta.* Similar to *apicata* Johannsen, differing only, to judge from the description, in having the prealar bristle long and the arista long plumose. Wisconsin and New York. Probably a synonym of *apicata.*

*inculta.* Described from one female. Related to *apicata.* South Dakota.

### Explanation of Figures

Fig. 1.—Head of *Neomuscina tripunctata* Van der Wulp.
Fig. 2.—Head of *Charadrella macrosoma* Van der Wulp.
Fig. 3.—Head of *Neomusca obscura* Van der Wulp.
Fig. 4.—Head of *Pseudophaonia orichalcea* Stein.
Fig. 5.—Head of *Pseudophaonia griseocaerulea* new species.
Fig. 6.—Head of *Dendrophaonia querceti* Bouché.
Fig. 7.—Head of *Dendrophaonia hilariformis* Stein.
Fig. 8.—Head of *Phaonia protuberans* new species.
Fig. 9.—Head of *Phaonia serva* Fallen.
Fig. 10.—Head of *Phaonia fuscisquama* Van der Wulp.
Fig. 11.—Head of *Phaonia harti* new species.
Fig. 12.—Head of *Phaonia striata* Stein.
Fig. 13.—Head of *Phaonia parviceps* Malloch.
Fig. 14.—Head of *Phaonia flava* Stein.
Fig. 15.—Head of *Phaonia pallida* Stein.
Fig. 16.—Head of *Phaonia subfusca* new species.
Fig. 17.—Head of *Phaonia fusca* Stein.
Fig. 18.—Head of *Phaonia prisca* Stein.
Fig. 19.—Hind femur and tibia of *Dendrophaonia hilariformis* Stein, male.[5]
Fig. 20.—Hind femur and tibia of *Dendrophaonia querceti* Bouché, male.
Fig. 21.—Apex of wing of *Phaonia curvinervis* new species.
Fig. 22.—Hind femur and tibia of *Phaonia atlanis* new species, male.
Fig. 23.—Hind femur and tibia of *Phaonia subfusca* new species, male.
Fig. 24.—Hind femur and tibia of *Phaonia delcta* Stein, male.

[5] Cal = Calcar; Ad = Apical dorsal; Apd = Apical posterodorsal.




HEBARD—DERMAPTERA AND ORTHOPTERA FROM SINALOA, MEXICO

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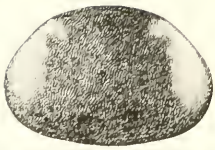

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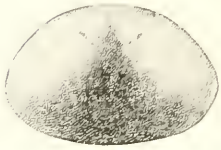

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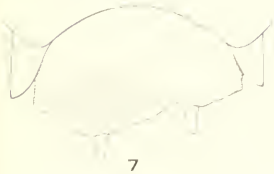

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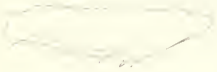

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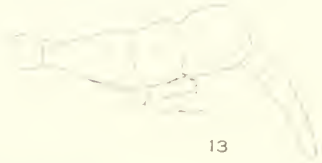

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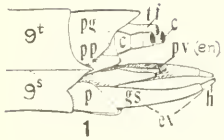


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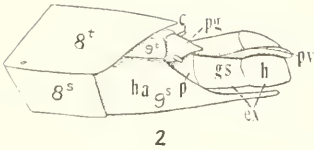


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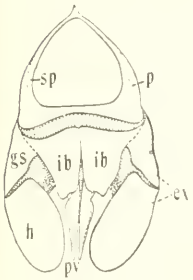


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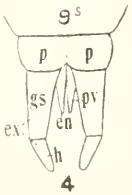


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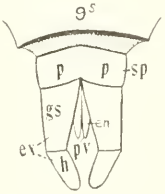


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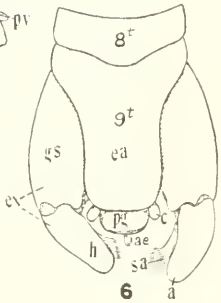


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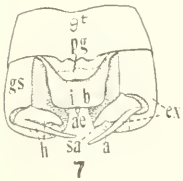


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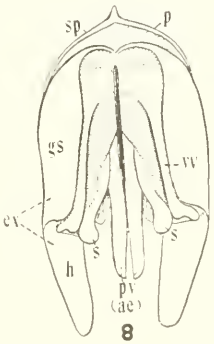


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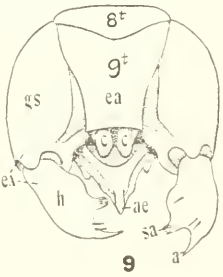


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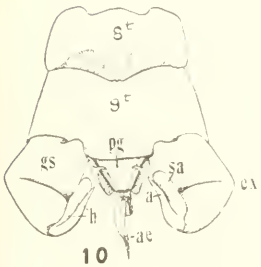


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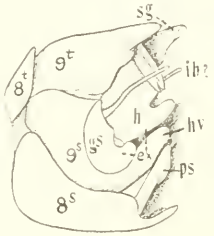


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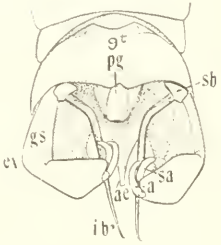


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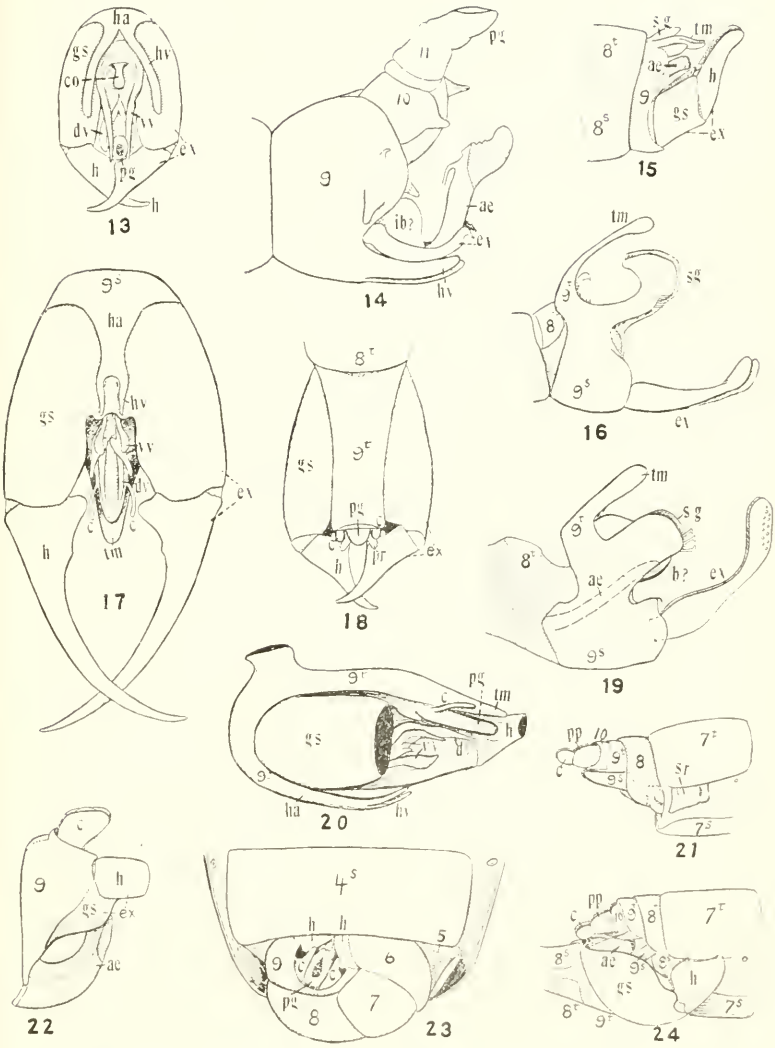
CRAMPTON—GENITALIA OF MALE DIPTERA AND MECOPTERA

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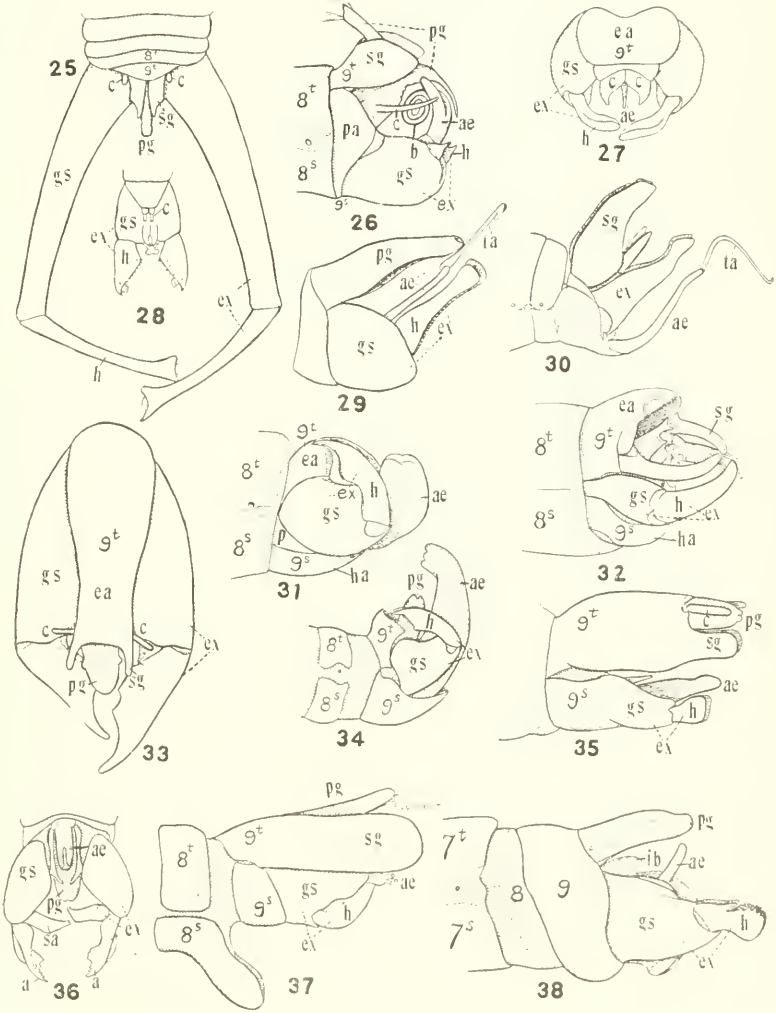


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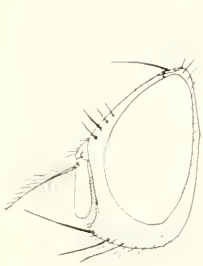

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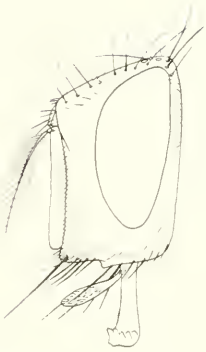

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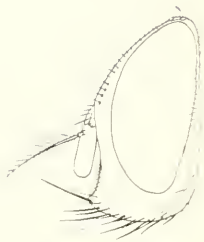

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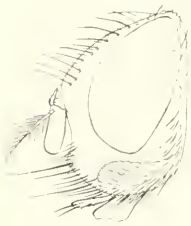

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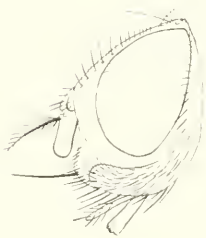

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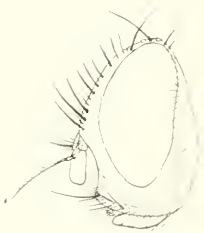

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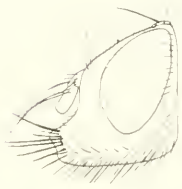

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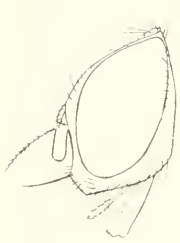

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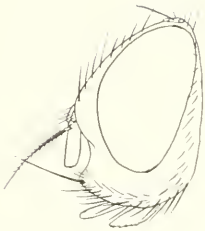

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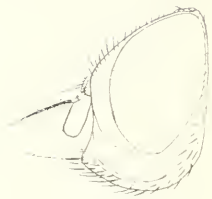

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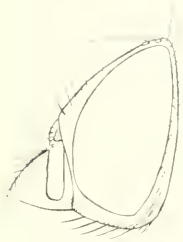

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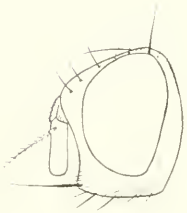

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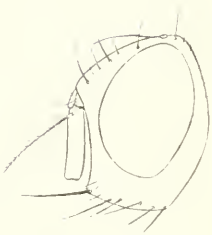

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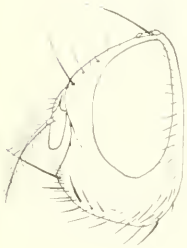

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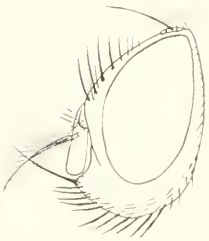

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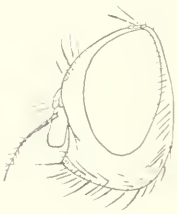

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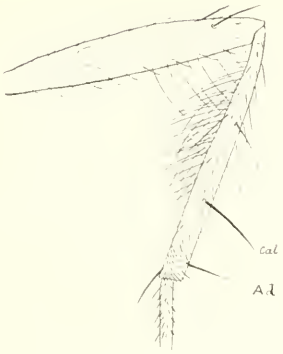


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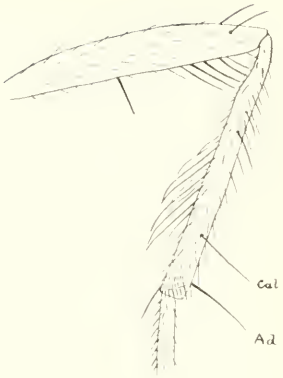


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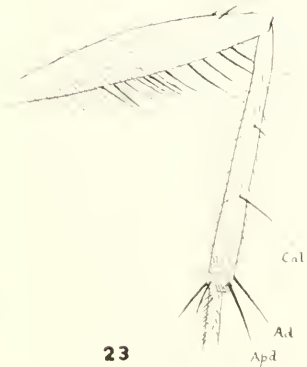


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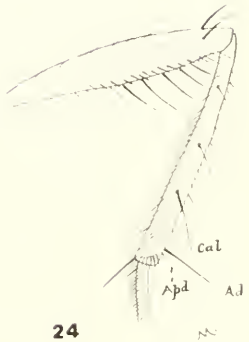


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# ON THE MALE GENITALIA OF THE HESPERIIDAE OF NORTH AMERICA

## PAPER II

BY HENRY SKINNER AND R. C. WILLIAMS, JR.

Attention is called to the authors' previous paper on the larger Hesperiidae.[1]

This paper will treat the remaining species of Hesperiinae in America north of Mexico and the West Indies, with the exception of those of the genus *Thanaos*, which have already been reviewed and most of the valvae figured by Scudder and Burgess,[2] Scudder,[3] Skinner,[4] and Lindsey.[5]

We have in general followed the classification adopted by Lindsey.[6] We prefer, however, to keep the genera *Hesperia* and *Heliopetes* separate, for the reason that they are readily differentiated by their superficial appearance, and while *Hesperia* is cosmopolitan, *Heliopetes* seems to be strictly neotropical. We also follow Godman and Salvin and retain *domicella* in *Heliopetes*. There is no indication in the male genitalia that this species is a connecting link between the two genera, and each of these might be divided into a number of groups in which the genitalia are highly specialized along different lines.

We follow Lindsey, however, in retaining a rather mixed lot of species in the genus *Pholisora*. The male genitalia show remarkable differences in species that in other characters appear to be closely allied,[7] so we do not believe it advisable to break up this genus.

Further deviations from the usual nomenclature are noted under the species and the reasons given.

[1] Trans. Amer. Ent. Soc., XLVIII, pp. 109–127, (1922).
[2] Proc. Bost. Soc. Nat. Hist., XIII, pp. 282–306, pl., (1870).
[3] Butterflies of the Eastern U. S. and Canada, (1889).
[4] Trans. Amer. Ent. Soc., XL, pp. 195–221, (1911).
[5] Bull. Lab. Nat. Hist. State Univ. Iowa, IX, (no. 4), pp. 49–55, pl. 2, (1921).
[6] Ibid.
[7] Note *catullus* and *mejicanus*.

The drawings were made from the genitalic mounts by Miss Helen Winchester.

The references under the species refer to previous figures of the male genitalia.

The records given are of insects which we have observed and in the collections of the Academy of Natural Sciences of Philadelphia, the American Entomological Society, and of R. C. Williams, Jr.

All references to genitalia in this paper refer to those of the male insect.

1. **Hesperia centaureae** Rambur (Fig. 1.)

Scudder, Butterflies East. U. S. and Canada, III, pl. 35, fig. 45, (1889).
Reverdin, in Oberthur, Étud. Lep. Comp., XII, pl. CCCCII, fig. 5202, (1916).

This species has both the costal fold and tibial tuft. American and European specimens are the same genitalically.

There is a single, beaked, terminal projection to the uncus; the scaphium is simple with small dentations on the external portion; the valve is of a pattern somewhat similar to that of *ruralis*, but with the central terminal recurved projection long and extended outwardly bayonet-shaped; the aedoeagus is simple.

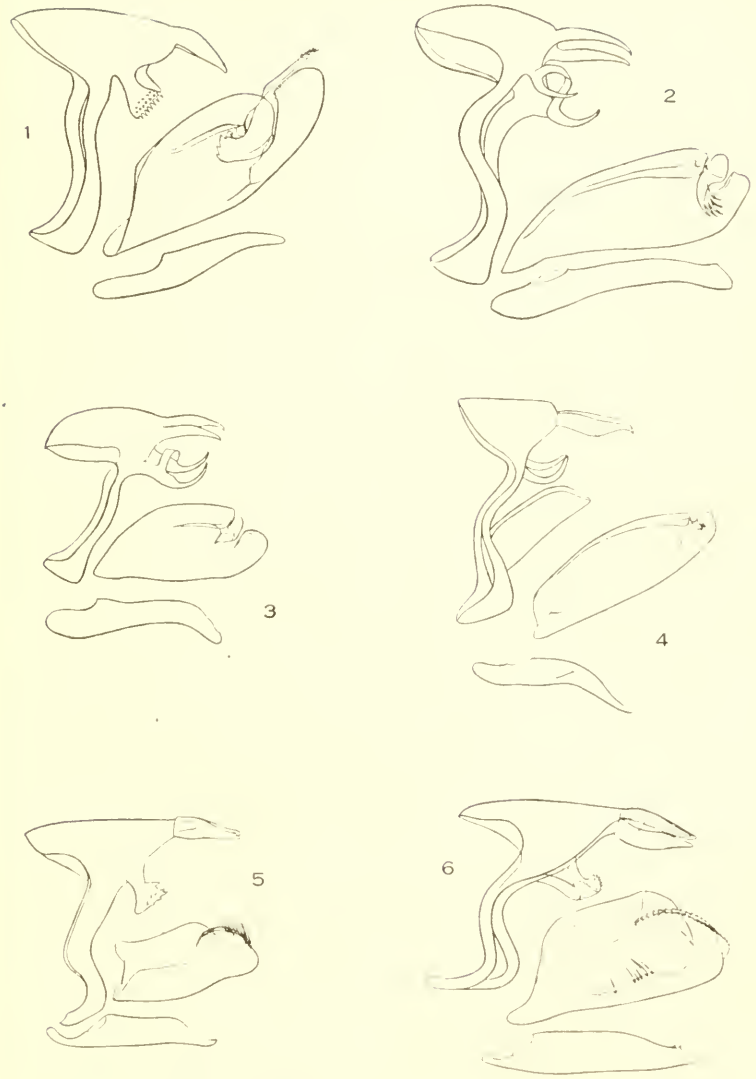
*Records:* NEW JERSEY, Iona, April (Skinner), Great Notch, Essex County; VIRGINIA, Montgomery County, April; COLORADO, Wilson Peak, Hall Valley, August (Oslar); ALBERTA, Laggan.

2. **Hesperia ruralis** Boisduval (Fig. 2.)

This species has both costal fold and tibial tuft.

*Ruralis* has a rather large uncus with two stout, well separated, beaked projections above, and two strong hooks below, the latter curving upwards, with a connecting band from base to base curved dorsally. The valve is split at its terminus and the ventral lobe carries a recurved process armed with a number of stout teeth. The aedoeagus is simple.

*Records:* COLORADO, Chimney Gulch, Golden, Bear Creek, Jefferson County (Oslar); UTAH, Silver Lake; CALIFORNIA, Albion, May (Sinclair), Santa Cruz, April and May (Dodge), Trinity County, June (Fox), Santa Clara County; WASHINGTON, Port Blakeley, Olympia; OREGON, Fort Klamath, Ashland.




1. *Hesperia centaureae*, Great Notch, Essex County, New Jersey. 2. *Hesperia ruralis*, Santa Cruz, California. 3. *Hesperia xanthus*, Jemez Mountains, New Mexico. 4. *Hesperia scriptura*, Trinidad, Colorado. 5. *Hesperia philetas*, Baboquivari Mountains, Arizona. 6. *Hesperia syrichtus*, Port de Paix, Haiti. (all × 17.)

3. **Hesperia xanthus** Edwards (Fig. 3.)

This species has the tibial tuft but no costal fold. It is very like *ruralis* in general appearance and maculation, and the pattern of the genitalia is similar.

The uncus is stout, carrying four hooks; the valve resembles that of *ruralis* except that the stout teeth of the recurved central process at the apex are lacking: the aedoeagus is simple.

*Records:* Colorado; New Mexico, Jemez Springs, May (Woodgate).

4. **Hesperia macdunnoughi** Oberthür

This name was proposed for a single male specimen (from Arizona ?) figured by Colot, but not described.[8] Another male is figured by Barnes and McDunnough,[9] from Redington, Arizona, and they state that it lacks the costal fold and is closely allied to *xanthus*, but smaller.

The markings of the secondaries below are unlike those of any of the series of *xanthus* and *ruralis* in our collections.

5. **Hesperia scriptura** Boisduval (Fig. 4.)

This species has the tibial tuft but lacks the costal fold.

The uncus carries two long stout divergent beaks; the scaphium is feebly developed; the valve is rounded at the apex, bilobed and carrying a small recurved process bearing fine spines; the aedoeagus carries near the middle a stout tooth. This species has a well developed juxta, like a folded leaf, in which the aedoeagus lies.

*Records:* Colorado, Trinidad, Chimney Gulch, June (Oslar), Poncha Springs; Arizona, Prescott; New Mexico, Highrolls (Viereck), Las Cruces.

6. **Hesperia philetas** Edwards (Fig. 5.)

This species has both costal fold and tibial tuft.

It was described from a single female from Western Texas (Boll), as being similar in its markings to *tessellata* above, but distinguished by the secondaries below, which are white with a yellow tint, without the discal band as in *tessellata*, but with a few brown dots and streaks, quite unlike any other American species.

[8] Oberthür, Étud. Lep. Comp., IX, p. 86, pl. CCLXIV, fig. 2205, (1913).
[9] Cont. Nat. Hist. Lep. N. A., III, pl. X, fig. 14, (1916).

The females which we have agree with the description; the males associated with them agree in the markings below, but usually have more white markings above. We have not, however, a male that just agrees with Lindsey's figure.[10]

The genitalia are more like those of *syrichtus* than those of any other American species. The tegumen is similar, ending in two projections; the scaphium with rather heavier serrations; the valve has a recurved hook at its apex, and in addition near and on the dorsal part numerous stout spines directed backward; the aedoeagus is simple.

*Records:* Texas, San Antonio; Arizona, Mt. Graham (Morrison), Baboquivari Mts., Pima County, July (Poling).

7. **Hesperia syrichtus** Fabricius (Fig. 6.)

Godman and Salvin, Biol. Cent. Amer., Rhop., III, pl. 90, fig. 27, (1899).
Reverdin, Bull., Soc. Lep. Genève, IV, pl. 5, figs. 1 (form a), 2 (form b), 3 (form c) and 4, 5, 6 (valvae enlarged), (1919).

This species has both costal fold and tibial tuft.

Dr. J. L. Reverdin, in the paper referred to above (p. 96 and 167), has published the results of his careful study of this species, presented excellent figures of the insect prepared by the artist Colot, photographic reproductions of the male genitalia of three forms, text figures showing variation in the aedoeagus, and extensive observations on the forms of the species and its geographic distribution.

The typical form of *syrichtus* is ashen, or black and white on the secondaries below, while the form *montivagus* Reakirt (*fumosa* Reverdin) is decidedly suffused with brown. Both forms occur in Central America, Mexico and the Antilles. We have the typical form from Texas, proving its occurrence in our fauna, but the prevailing form above the Mexican border and in Florida is *montivagus*.

The terminal of the uncus is cleft; the scaphium consists of two arms shagreened at their turned up terminals and connected together with an arch from their bases; the valve has a rounded apex, the dorsal edge produced backward in a curve the outer portion of which is strongly dentate; the aedoeagus is provided with some teeth at the apex varying in number and shape.

[10] Univ. of Iowa Studies in Nat. Hist., IX, pl. 1, fig. 7, (1921).

*Record:* near Corpus Christi, southern Texas (Aaron).

There is a third form or perhaps a distinct species (*syrichtides* Reverdin), also occurring in Central America, Mexico and the Antilles, which is very like the typical form in color and maculation but which differs genitalically in the shape of the valve, in that the terminal rounded end is not extended so far backwards, but ends in a more substantial projection shaped like the toe of a slipper, and the aedoeagus is provided with a single stout tooth at its terminal. This form or species, however, does not seem to enter the United States.

a. form **montivagus** Reakirt

This was originally described from "Rocky Mountains, Colorado Territory" and is the prevailing form above the Mexican line.

The genitalia are the same as those of typical *syrichtus*.

*Records:* Colorado; Florida, Key West (Morrison); Southern Arizona (Poling).

8. **Hesperia tessellata** Scudder (Fig. 7.)

Scudder, Butterflies East. U. S. and Can., III, pl. 35, fig. 39 (valve), 40 (uncus) (as *montivagus*), (1889).

Reverdin, Bull. Soc. Lep. Genève, IV, pl. 7, fig. 1 (typical) and 4–8 (details and aberrant formations), (1921).

This species has the costal fold but lacks the tibial tuft.

Reverdin in the paper referred to above (pp. 168–181), has presented lithographic figures of the insect by Colot (Plate 6, figs. 9, 10, 11, 12, 15), sketches of the variation in the valve (p. 177), and published the results of his careful study of its genitalic variation and geographic distribution, from the examination of a large number of specimens.

He concludes that it is a widely spread species, subject to considerable variation in its habitat from Surinam, through Central America, Mexico and throughout the United States, and within these limits divides the species into three classes; first those with a large toothed protuberance at the end of the valve; second, intermediate forms; and third, those which are without this protuberance and teeth. The first class roughly covers the territory to the east and north of the United States; the second, the States adjoining the Mexican boundary and well

up into California; the third, Arizona, Texas and to the South. He places *occidentalis* Skinner as a variety.

*Tessellata* was described by Scudder from Missouri, and has priority over *Hesperia communis* Grote (one male, one female; Central Alabama), the types of which are in the collection of the Academy of Natural Sciences of Philadelphia, and are so labelled in the handwriting of A. R. Grote. *Communis* is a synonym of *tessellata*.

The uncus is split at its apex; the scaphium is peculiar in that from its middle there projects inwardly a T-shaped process; the valve is rounded at its extremity and carries a process turned inwardly and upwardly ending usually with a double tooth, beyond which there is a long cylindrical arm extending inwardly almost the length of the valve, and with its end strongly denticulate; the aedoeagus is simple.

a. var. **occidentalis** Skinner (Fig. 8.)

Biol. Cent.-Amer., Rhop., pl. 90, fig. 30, (1899) (as *montivaga*).

This was originally described as a species,[11] as "smaller and generally whiter—than *tessellata*—found in the Northwest territory and in the Southwest generally." The same year *occidentalis*, *tessellata* and *syrichtus* were figured by the author and comparisons made.[12]

We now select from the type material a male from San Antonio, Texas, as the single type. It is like the figured specimens referred to above. Some paratypes, from Ysleta, Texas, April, are still smaller and whiter, and a specimen from the Northwest territory, figured by Reverdin[13] has the ground color still further encroached upon by the white markings. This last, however, cannot be considered typical of *occidentalis*, but an aberration of *tessellata*. The specimen figured by Reverdin as *occidentalis*[14] is darker and larger than any in the type lot.

The name should be restricted to apply only to the smaller, paler form of the species inhabiting the low arid regions along

[11] Ent. News., XVII, p. 96, (1906).
[12] L. c., p. 277, pl. XII.
[13] Bull. Soc. Lep. Genève, IV, pl. 6, fig. 9, (1919).
[14] L. c., fig. 11.

the Rio Grande to the north and south, and thence to and up the Californian coast.

The genitalia of *occidentalis* are the same as those of *tessellata* except that the valve lacks the toothed projection.

*Records:* Texas, Ysleta, El Paso, Corpus Christi, Round Mountain; Arizona, Tucson; New Mexico, Highrolls, Alamogordo; California, La Jolla, November (Williams), Dobel.

9. **Heliopetes domicella** Erichson (Fig. 9.)

This species has the costal fold and tibial tuft.

The tegumen is provided with a long uncus, ending in a large truncate projection densely covered with hairs projecting backwards; the scaphium is shagreened at its apex; the valve is split at its terminus, the dorsal lobe rounded and the ventral lobe larger, convolute, and serrate on the caudal margin; the aedoeagus is simple.

The tegumen is quite unlike that of any of the species of *Hesperia* or any other species of *Heliopetes* that we have examined.

*Records:* Arizona, Tucson; Mexico, Colima; Argentine Republic, La Rioja.

10. **Heliopetes ericetorum** Boisduval (Fig. 10.)

This species has the costal fold and tibial tuft.

The type has been admirably figured by Oberthür[15] and Lindsey has figured both sexes.[16]

The uncus ends in split slender beaked processes; the scaphium is present and in addition the girdle of the tegumen is expanded outwardly on each side, bearing below the scaphium substantial projecting arms dentate at their outer ends. The valve is split at the terminus, the ventral portion hooked and with small teeth at the end; the aedoeagus is simple.

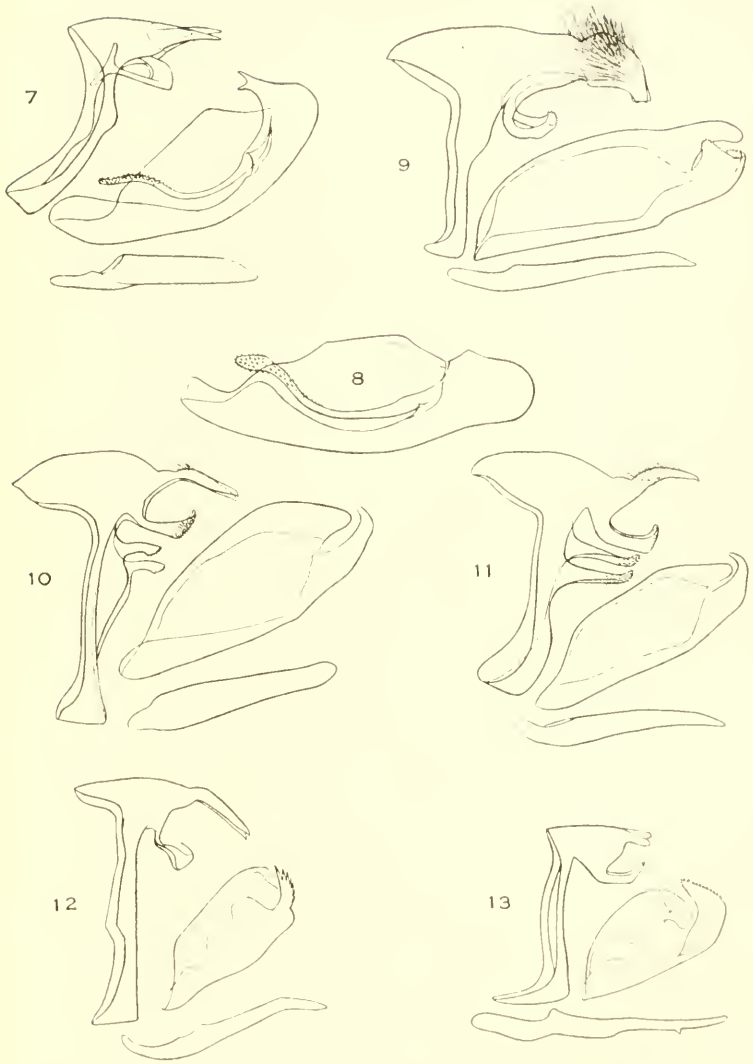
*Records:* Oregon; California, Los Angeles, Riverside, Havilah, Mt. Pinos, Ventura County, September (Rehn and Hebard); Arizona, Mt. Graham.

11. **Heliopetes laviana** Hewitson (Fig. 11.)

This species has the costal fold and tibial tuft. It enters our fauna in Texas, from whence it extends south well into South America.

[15] Étud. Lep. Comp., vi, pl. 137, fig. 1210, (1912).

[16] Univ. Iowa Studies in Nat. Hist., ix, pl. 1, figs. 4 and 6, (1921).




7. *Hesperia tessellata*, Dakota. 8. *H. tessellata* race *occidentalis*, Tucson, Arizona. 9. *Heliopetes domicella*, La Rioja, Argentine Republic. 10. *Heliopetes cricetorum*, Southern California. 11. *Heliopetes laviana*, Chapada, Brazil. 12. *Heliopetes macaira*, Corpus Christi, Texas. 13. *Celotes nessus*, Corpus Christi, Texas. (all × 16.)

The genitalia are of the same general pattern as those of *ericetorum*, the arms projecting from the sides of the girdle are, however, about twice as long.

*Records:* MEXICO, Colima, Yucatan; BRAZIL, Chapada; PARAGUAY, Villa Rica.

12. **Heliopetes macaira** Reakirt (Fig. 12.)

This species has the costal fold and tibial tuft. It enters our territory in Texas and extends south through Mexico and Central America.

Our Texan and Mexican material shows considerable variation in the amount of brown encroaching on the white ground. Above, some specimens are immaculate on the secondaries (*oceanus* Edwards), in others there is considerable blackish brown at the ends of the veins and even along the entire margin. Below we have a condition ranging from small brown spots and broken terminal band, to brown color covering almost the entire surface of the secondaries. The pattern, however, is the same with varying insistence.

Godman and Salvin rather suggest that *nivella* may be but a varietal form of *macaira*, and our observations lead us to believe that such is the case. The genitalia of the two forms are the same.

There is a great variation in the amount of the brown-black markings in the allied species *alana*, *arsalte* and *laviana*, of which we have long series from Central America and Mexico, and an analogy is found in an unidentified species, very closely allied, from southern Brazil, which shows a similar variation equally great.

The principal differences we recognize to separate the typical form from its variety is to be found in the maculation of the secondaries. *Macaira* is described as immaculate above and with a broad brown band extending across the outer border below, while *nivella* is described as with blackish brown on the border above and with two patches on the under side at the outer border.

We accept the synonymy as given by Godman and Salvin, who were in a position to have access to types and authentic material.

*Macaira* is figured by Hewitson[17] as *locutia* Hewitson from the Island of Taboga, Panama.

The uncus is proportionately smaller than that of the two preceding species, its projecting beaks are similar, but this species lacks the arms projecting from the sides of the girdle. The valve carries at its apex on the ventral lobe a stoutly thorned process; the aedoeagus is simple.

*Records:* Texas, Corpus Christi (Aaron); Mexico, Mazatlan, Colima, Sonora.

a. var. **nivella** Mabille

Biol. Cent.-Amer., Rhopal., pl. 90, fig. 24, (1899).

This insect is reported from Brownsville, Texas, as is also typical *macaira*. It is well figured by Godman and Salvin[18], who state, as we find to be the case, that the genitalia are the same as those of *macaira*.

*Records:* Mexico, La Joya, Colima, Yucatan.

13. **Celotes nessus** Edwards (Fig. 13.)

Biol. Cent.-Amer., Rhopalocera, pl. 91, fig. 29, (1899).

This species has the costal fold and tibial tuft.

Lindsey places it in the genus *Systasea* with *pulverulenta*. It has, however, a very different appearance, and the genitalia also differ so decidedly that this association can hardly hold. Its near allies are of the genus *Carcharodus*, but a comparison of the genitalia with those of *malvarum* Hoffmannsegg (= *alceae* Esper), with which it was associated by Strecker when he described *notabilis* (= *nessus*), does not disclose a sufficient similarity to necessitate its transference to *Carcharodus*, and we therefore place it in *Celotes*, which Godman and Salvin erected for it.

The uncus is short with split terminals; the scaphium prominent and set well up on the uncus; the saccus is produced into the abdomen more than in other species of the allied groups; the ventral lobe of the valve, extended beyond the dorsal lobe is serrate on its recurved outer margin; the aedoeagus is relatively large and long and bears a tooth near its apex.

[17] Exot. Butt., v, Leucochitonea II, figs. 19 and 20, (1875).

[18] Supra, pl. 90, figs. 22 and 23.

*Records:* Texas, Corpus Christi (Aaron), New Braunfels, Round Mountain, San Antonio, Kerrville; Arizona, Baboquivari Mts., Pima County (Poling); New Mexico, Alamogordo; Mexico, Sonora.

14. **Pholisora catullus** Fabricius (Fig. 14.)

Scudder, Butterflies, pl. 35, figs. 41 (valve), 42 (uncus), 43 (tip of uncus), (1889).

None of the species of *Pholisora* in our fauna has the tibial tuft. This species has the costal fold.

The uncus ends in a single projection with three terminal beaks, at the base of which the uncus is divided, showing two lobes; the scaphium is strongly chitinous with some shagreenation at the apical surface; the lobes of the valve are rounded at the end, the ventral dentate outwardly and bearing a stout incurved spine, set just before the apex; the aedoeagus is remarkable in that at its apex there is a strong recurved hook on the dorsal side, it also carries some internal hair-like spines.

15. **Pholisora mejicanus** Reakirt (Fig. 15.)

Biol. Cent.-Amer., Rhopalocera, pl. 90, fig. 12 (as *mexicana*), (1897).

This species has the costal fold. It is very like *catullus* above, but the secondaries below have a purplish tint and the veins are conspicuous in a darker fuscous color. It is a Mexican species occasionally taken across the border. Mr. William Schaus kindly sent us some specimens from Jalapa and Oaxaca, Mexico, for study.

The uncus is stout and long, ending in a single claw, short, and broad at its base; the scaphium is hardly present; the valve appears truncate, the ventral lobe sharply rounded and bent up and back terminating in a point, the outer margin finely denticulate, overlapping the rounded costal lobe; the aedoeagus is simple, doubly bent.

16. **Pholisora alpheus** Edwards (Fig. 16.)

Biol. Cent.-Amer., Rhopalocera, pl. 90, fig. 15, (1897).

This species lacks the costal fold.

The uncus is stout, terminating in a cylindrical projection with a blunt end; the scaphium is well developed and with dentations on the central super-apical surface; the valve is relatively

small, simple, and terminating in a long bayonet, turned upwardly; the aedoeagus is peculiar in that its base is T-shaped, in nature set in a horizontal plane.

*Records:* Arizona, Mt. Graham (Morrison), Gadsden (Schiffel), Florence (Biederman); New Mexico, Alamogordo, April, May (Viereck and Rehn), Las Cruces.

17. **Pholisora arizonensis** Mabille & Boullet

Under the name *Hesperopsis arizonensis* these authors have described an insect in a recent paper.[19] A free translation of the original French description follows.

"Four wings black with a long brown fringe cut into here and there with yellow. Primaries above with two apical points and two other points not so distinct placed obliquely in three and four; a terminal row of clear (pale) points on the external border; some appearance of yellowish scales on the disc. Secondaries above of a uniform black with a terminal row of clear points hardly visible, and an indistinct dash in the cellule. Primaries below uniform black brown with two well marked apical points, some white hatching along the costa above the apical points, one perceives the two points on three and four and the terminal row of clear points. Secondaries below; on the brown-black ground is easily seen the terminal row of clear points and a sickle-shaped trace in the cellule. Palpi white; at the base of the antennae a little tuft of white hairs.

Arizona, U. S., one ♂: Boullet Collection, Paris Museum."

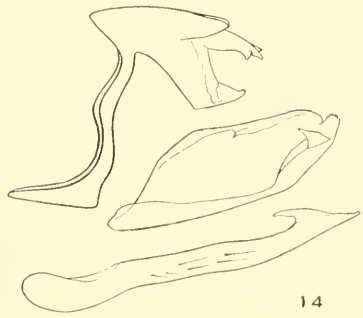
We think this is *alpheus*.

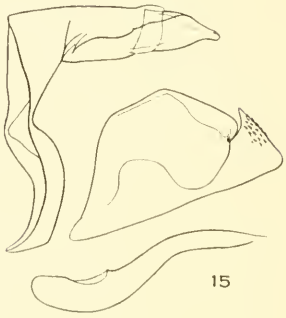
18. **Pholisora libya** Scudder (Fig. 17.)

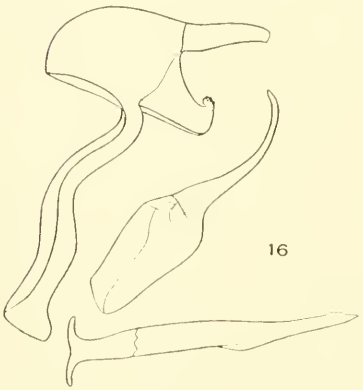
This species lacks the costal fold. *Libya* varies greatly in the number of white spots on the wings, both above and below. *Lena* of Edwards appears to be the same species as *libya*, described from specimens having few spots on the primaries above and one spot on the secondaries below. The genitalia of *libya* and of the one spotted form (*lena*) are alike.

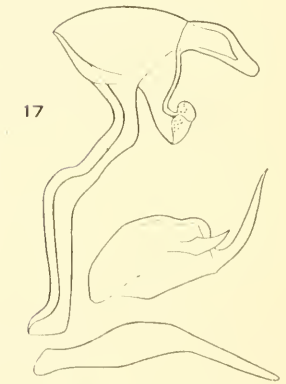
The type information of *libya* is, one male, two females, "Beaver Dam," April 20–28, Arizona (25 miles to west of south of St. George, Utah). The type information of *lena* is, one male, one female, Montana. We have specimens of this from the White River, Colorado.

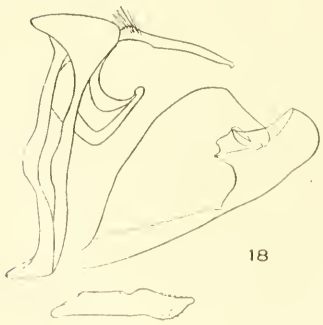
[19] Bull. Soc. Ent. France, 1917, p. 100.

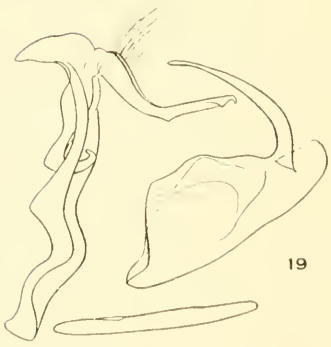



14. *Pholisora catullus*, San Antonio, Texas. (× 20.) 15. *Pholisora mejicanus*, Oaxaca, Mexico. (× 20.) 16. *Pholisora alpheus*, Gadsden, Arizona. (× 30.) 17. *Pholisora libya*, Florence, Arizona. (× 30.) 18. *Pholisora ceos*, Mount Graham, Arizona. (× 20.) 19. *Pholisora hayhurstii*, Quincy, Illinois. (× 20.)

The uncus ends in a cylindrical blunt process; the scaphium is well developed, ending in a double lobe, well dentated; the valve is not split apically but carries from the ventral side a long sickle-shaped process, curved upwards, and from the center another stout process shaped like a spear head; the aedoeagus is simple but swollen in its median area.

*Records:* Arizona, Florence, September (Biederman); Utah, Stockton, July (Spalding); Nevada, Beatty, August (Rehn and Hebard), Humboldt Lake; California, San Diego County (Coquillett), Indian Wells, September (Coolidge), San Bernardino (Wright), Coalinga, Fresno County, August (Rehn and Hebard), Lancaster.

19. **Pholisora ceos** Edwards (Fig. 18.)

Biol. Cent.-Amer., Rhopalocera, pl. 89, fig. 8, (1896).

This species has the costal fold. It is readily distinguished from the other species of our fauna by the orange color of the hair of the head and palpi above.

There is a long, slender, jointed projection from the uncus; the scaphium is present, long and slender; the valve has the ventral lobe projecting, rounded and set with short hairs, the dorsal lobe is wide, rounded; the aedoeagus is very short, the apical portion swollen and bearing numerous small teeth.

*Records:* Arizona, Mt. Graham (Morrison), Tucson; Mexico, Sonora (Morrison).

20. **Pholisora hayhurstii** Edwards (Fig. 19.)

Biol. Cent.-Amer., Rhopalocera, pl. 89, fig. 16, (1896).

This species has the costal fold.

The uncus has a peculiar terminal, bent downwards in the middle, long and ending in a well developed beak, there is a tuft of hairs directed upwards, at the base of this projection; the scaphium is long, almost like a second girdle, extending down almost to the center of the tegumen; the valve has a rounded ventral lobe but dorsally carries a long rod curved inwardly; the aedoeagus is simple.

*Records:* Texas, San Antonio, Round Mountain; Florida, Miami, June (Hebard).

21. **Pholisora ascalaphus** Staudinger (Fig. 20.)
Biol. Cent.-Amer., Rhopalocera, pl. 89, fig. 14, (1896).

This species has the costal fold.

It was described as *Helias ascalaphus* by Staudinger[20] from Chiriqui, Panama. It is figured by Godman and Salvin,[21] who state that "it is a very common insect all over Central America and southern Mexico up to an elevation of 4000 or 5000 feet above sea level.—In outward appearance *S*[*taphylus*] *ascalaphus* is very like the North American *S. hayhursti*, both having a similarly shaped outer margin to the secondaries. *S. hayhursti* is a little paler in colour, the faint marking of the wings rather more plainly shown, and the palpi purer white beneath."

We have a small series of both sexes of this species from near Corpus Christi, Texas (Aaron), which have been in the Academy Collection over the *hayhurstii* label since 1884.

The tegumen is similar to that of *hayhurstii;* the uncus carries a similar projecting process bent sharply downward and then up, ending in a hook, and bearing a tuft of hairs at its base; the valve is rounded at its apical end, in and on which it bears numerous stout spines directed upwards; the aedoeagus is simple.

22. **Pholisora brennus** Godman and Salvin[22] (Fig. 21.)
Biol. Cent.-Amer., Rhopalocera, pl. 89, fig. 23, (1896).

This species has the costal fold. *Staphylus brennus* Godman and Salvin[23] was described from two specimens from Chiriqui, Panama, which were received from Staudinger with the manuscript name *brennus* Mabille. We have had specimens from the Skinner Collection, in the Academy Collection for many years, marked *brennus*, Chiriqui, Staudinger, which now turn out to be *imbras*, so the identification of the insects of the Runyon catch, not now available, is doubtful, and the southern species which crosses the Mexican boundary may be *brennus* or *imbras*.

[20] Verh. Zool.-bot. Gesell. Wien, xxv, p. 116, (1876).

[21] Biol. Cent.-Amer., Rhopalocera, p. 432, pl. 89, figs. 13, 14 ♂, 15 ♀, (1897).

A free translation of the original description of *brennus* follows:

"Wings fuscous-brown almost immaculate; sparsely scattered with yellow scales; anteriors with a hardly paler submarginal band, without hyaline spots; palpi below with blackish and yellow scales intermixed with the long vestiture."

The insect was not figured, but the name is fixed by the description and the figure of the genitalia. We figure the genitalia of both *brennus* and *imbras*.

The uncus of *brennus* ends in a single slender projection, and itself is incised on each side; the scaphium is scarcely developed; the ventral lobe of the valve terminates in a cordate section overlapping the ventral portion, rounded apically and serrate on its outer ridge; the aedoeagus is slender, carrying internally a few small spines.

*Record:* Mexico, Texola, Vera Cruz.

23. **Systasea pulverulenta** Felder (Fig. 23.)

This species has the costal fold. A fluted or incised margin to the secondaries is characteristic of the genus.

[22] 22a. *Pholisora imbras* Godman and Salvin (Fig. 22.).

Biol. Cent.-Amer. Rhopalocera, pl. 89, fig. 28, (1896).

This species has the costal fold.

*Staphylus imbras* was described by Godman and Salvin, (Biol. Cent.-Amer., Rhopalocera, p. 435, pl. 89, figs. 27 [♂] 29 [♀], (1897)), from a considerable series from Mexico and Guatemala, the type presumably from Misantla, Mexico (first named locality). A free translation of the original Latin description follows.

"Wings deeply fuscous-brown with an obscure band hardly noticeable; anteriors without subapical hyaline spots (♂); palpi below ochraceous yellow scales intermixed with blackish.

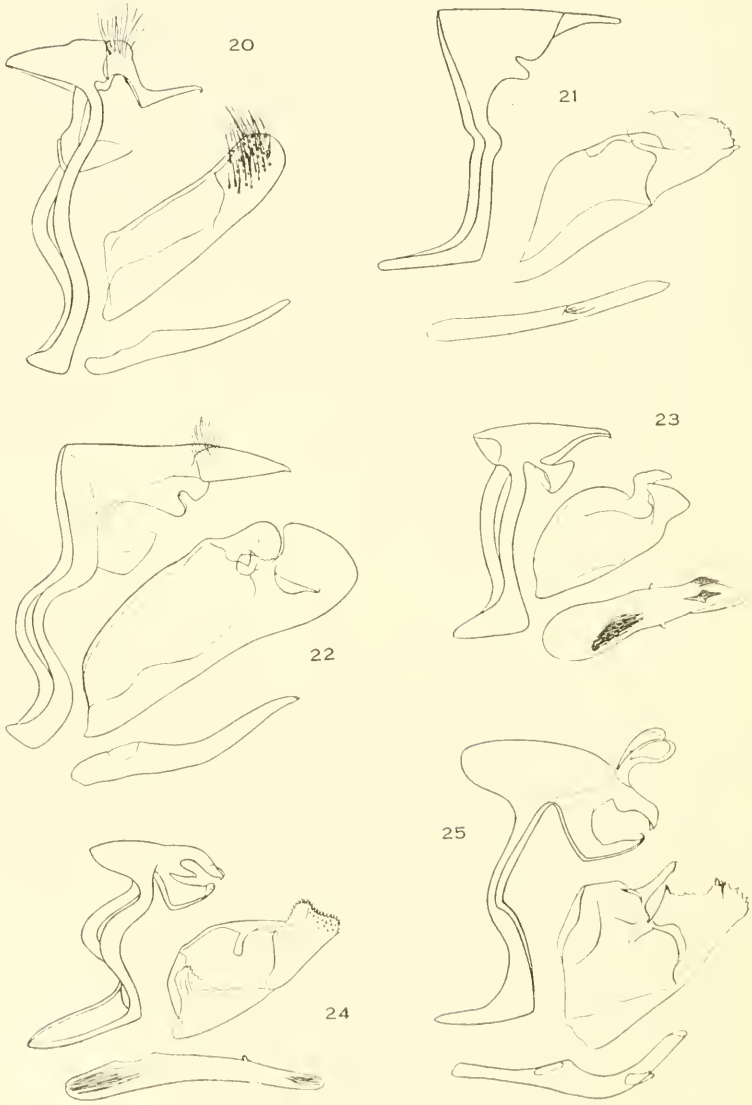
"♀ similar, but larger, the obscure band larger, obvious and anteriorly supplied with three subapical hyaline spots."

They further state it is exceedingly like *brennus*, but has rather less prominent joints to the palpi. Our specimens further show a greater expanse for *imbras* namely, 16 mm., from thorax to apex of wing against 14 mm. for *brennus*, *hayhurstii* and *ascalaphus*.

The uncus ends in a stout bulbous process, there are incisions on each side of the uncus; the ventral lobe of the valve, rounded apically, projects beyond the discal lobe and where they meet the chitin of both is convoluted; the aedoeagus is simple, somewhat bent in the middle.

*Records:* Panama, Gatun, Canal Zone (Harrower), Chiriqui; Guatemala, Quirigua (Rhoads).

[23] Biol. Cent.-Amer., Rhopalocera, p. 434.




20. *Pholisora ascalaphus*, Corpus Christi, Texas. (× 20.) 21. *Pholisora brennus*, Texola, Mexico. (× 20.) 22. *Pholisora imbras*, Quirigua, Guatemala. (× 20.) 23. *Systasea pulverulenta*, Corpus Christi, Texas. (× 15.) 24. *Xenophanes tryxus*, Colima, Mexico. (× 15.) 25. *Eantis thraso*, Chapada, Brazil. (× 15.)

The uncus is cleft and a substantial scaphium is present at its base; the valve ends in two somewhat complicated spatulate projections; the aedoeagus in remarkable is that it carries internally a sponge-like bristling mass, and just before the apical end there are two stout projections of the shape of a bird's head. The congeneric species *erosa* Hübner has a similar aedoeagus, containing the hairy mass and provided with a pair of stout hooked spines near the apex.

*Records:* Texas, Corpus Christi (Aaron), San Antonio; New Mexico, Alamogordo, May (Viereck and Rehn); Mexico, Sonora (Morrison).

24. **Xenophanes tryxus** Cramer (Fig. 24.)

Biol. Cent.-Amer., Rhopalocera, pl. 85, fig. 18, (1895).

This species has neither costal fold nor tibial tuft. From South America, through Central America and Mexico, it enters our territory in Texas. Lindsey gives a figure of the male in his paper.[24]

The uncus bears a terminal projection split at the apex, and at the base bearing short lobes; the scaphium is well developed, carrying two apical shagreened lobes; the saccus is broad and extends well into the abdomen; the valve appears to be truncate, the apical margin serrate and bent in two planes, the ventral part carries a rounded, shagreened internal process near the base, and the dorsal part a more slender denticulated lobe medianally; the aedoeagus contains a tuft of hairs at the base and some near the apex.

25. **Eantis thraso** Hübner (Fig. 25.)

Biol. Cent.-Amer., Rhopalocera, pl. 87, fig. 7, (1895).

This species has neither costal fold nor tibial tuft. It is a southern species entering our territory in Texas. In this genus the primaries are pointed at the apex and just below there is a slight excavation on the outer margin. Lindsey gives a figure of the male.[25]

The uncus is well developed, carrying a stout blunt beak, and at the base of this a prominent pair of upright processes like rabbit-ears. These ears seem to be characteristic of the genus.

[24] Pl. I, fig. 3.

[25] Pl. I, fig. 8.

The scaphium is well developed; the ventral lobe of the valve ends in a serrate, truncate pocket with some stout teeth; the dorsal lobe carries a rod with fine teeth at its apex; the aedoeagus is bent sharply upwards beyond the middle and carries a strong tooth with several points.

*Records:* Texas, Corpus Christi (Aaron); Mexico, Alta Mira, Tamaulipas, October; Brazil, Chapada.

26. **Ephyriades brunnea** Herrich-Schaeffer (Fig. 26.)

This species has the costal fold but lacks the tibial tuft.

It is a West Indian species, reported from Sugar Loaf Key, Florida. R. C. Williams caught a female in Miami, Florida, February 25, 1913. The male is figured by Lindsey.[26] Our female has nine hyaline spots on the primaries, seven of which correspond to those on the male of *brunnea*, and in addition, one minute one on the costa and, one, a streak, below the cell. There are two bands and a basal spot on the primaries of a violet tinge, and an indistinct band, lighter than the brown ground color, on the secondaries.

We have quite a series of *brunnea* males, and the females associated with them from localities in the records given below. We believe the identification is correct, but attention is called to the fact that it is difficult to separate these females from those which have been ascribed to *arcas* Drury (*flyas* Cramer, *velasquez* Lucas) i. e. *otreus* Cramer (*zephodes* Hübner).

Gundlach[27] separates the females by the size of the hyaline spots, stating that those of *arcas* are larger and that the lower or sub-cellular one in *brunnea* is a line, and in *arcas* is triangular or subquadrate. He further states that he had the originals of *zephodes* Hübner, and observed females of this form in coitus with *brunnea* in Cuba, and his friend Klug observed the same in Porto Rico.

The Cramer figures of *flyas* and *otreus* appear on the same plate, and the habitat in each case is given as Surinam,—circumstantial evidence that they may have come from the same catch and may be male and female of one species.

There are intergradations, however, in our own series, so, against this hypothesis that *brunnea* and *arcas*, two very distinct

[26] Pl. I, fig. 10.

[27] Cont. Ent. Cuba, p. 142, (1881).

males, have females which are very similar and only separable in their extreme forms or by association, is the possibility that all the females mentioned above belong to *brunnea*, and that the female of *arcas* is as yet not discovered or, if described, not properly assigned.

In his paper on the Lepidoptera of the Isle of Pines, Holland[28] calls the species *otreus* with *brunnea* as a variety. According to our hypothesis *brunnea* male is represented by his figure 5; female by figure 4, and figure 3 might be the female of *arcas*. He had two males of *arcas* but associated no female with it.

*Electra* Lintner[29] is also the female of *brunnea* or *arcas*, probably the former, arriving at Hamilton, Ontario, from the tropics on fruit, as Skinner suggests.[30]

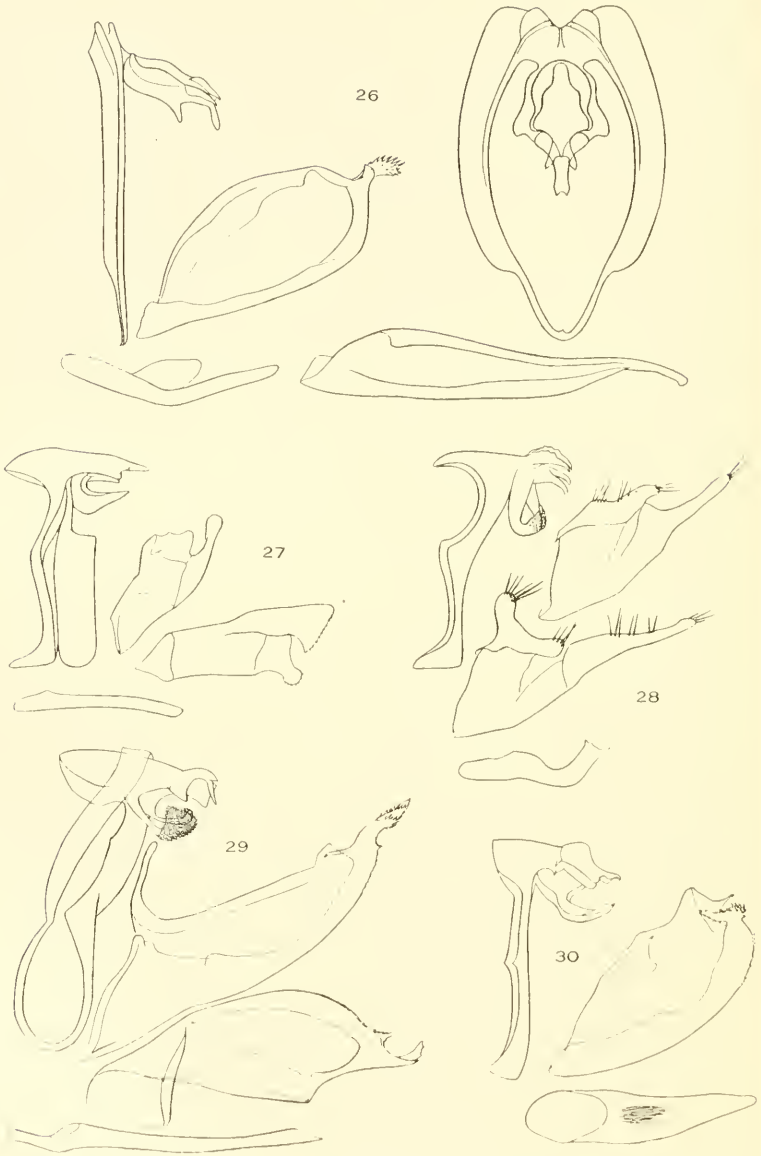
*Brunnea* and *arcas* we believe to be congeneric, and a comparison of the genitalia confirms this conclusion. The latter species has, in addition to the costal fold, a tibial tuft, but we do not believe that this difference is of generic importance. We therefore adopt the earliest generic name *Ephyriades* Hübner,[31] of which *otreus* is the first named species, designated by Scudder[32] as the type.

The pattern of the hyaline spots indicates relationship with *Cogia*, and the asymmetric valvae connects them with *Thanaos*.

The tegumen is peculiar and complicated; it lacks the hood or bonnet of our previously treated hesperiids. The girdle, produced laterally, extends above the uncus, which with its projecting processes extends downwards almost into the girdle. The right valve is broad and rounded outwardly, carrying at the apex a spatulate spined arm; the left valve is narrow, long and tapering from the base to the apex, ending in a blunt rod. The aedoeagus is bent in the middle where it carries a broad dorsal lobe.

*Records:* Cuba, ♂, ♀ (Poey Collection), ♂, Guantanamo, August, April, ♀, August (Ramsden); Haiti, ♂ (Abbott).

[28] Ann. Carnegie Mus., x, p. 504, pl. 31, figs. 3, 4, and 5, (1916).
[29] Can. Ent., xiii, p. 63, (1881).
[30] Trans. Amer. Ent. Soc., xxxvii, p. 208, (1911).
[31] Verz. bek. Schmett., p. 111, (1816).
[32] Proc. Amer. Acad. Arts and Sci., x, p. 161, (1875).




26. *Ephyriades brunnea*, Guantanamo, Cuba. 27. *Chiomara asychis*, Corumbá, Brazil. 28. *Thanaos gesta*, Haiti. 29. *Timochares ruptifasciatus*, Northern Mexico? 30. *Grais stigmaticus*, Chapada, Brazil. (all × 14.)

27. **Chiomara asychis** Cramer (Fig. 27.)

Biol. Cent.-Amer., Rhopalocera, pl. 91, fig. 3, (1899).

This species lacks the costal fold. It is another South and Central American species, crossing the Mexican border into Texas and Arizona.

The valvae are asymmetric and very like those of the genus *Thanaos*. The uncus ends in a short beak; the scaphium is well developed, set with very fine short hairs outwardly; the girdle of the tegumen is not symmetrical, the left side being extended to meet the shorter valve; the right valve ends ventrally in a spatulate projection extending beyond the dorsal lobe, the latter having a fluted outer margin; the left valve ends ventrally in a triangular lobe serrate on the caudal margin, and projecting beyond the dorsal lobe, the latter ending in a projection with a round serrate outer margin; the aedoeagus is simple.

28. **Thanaos gesta** Herrich-Schaeffer (Fig. 28.)

Biol. Cent.-Amer., Rhopalocera, pl. 91, fig. 9, (1899).

This species is without the costal fold. It is from the West Indies, Central America and Mexico, crossing the border into Texas and Arizona. We believe Lindsey to be correct in placing it in the genus *Thanaos*.

The uncus ends in a pair of hooks, the dorsal ridges of which are serrate and also bear some small spines, at the base of these there projects a second pair of smooth beaks; the scaphium is developed and denticulate outwardly; the right valve ends ventrally in a long slender rod and dorsally in a single rounded projection; the left valve ends ventrally in a long tapering rod and dorsally in a double rounded lobe at right angles to the axis; both valves have their dorsal and apical areas set with sharp spines; the aedoeagus is simple but sharply curved up near its apex.

29. **Timochares ruptifasciatus** Plotz (Fig. 29.)

Biol. Cent.-Amer., Rhopalocera, pl. 88, fig. 3, (1896).

This species has both costal fold and tibial tuft.

It is from Mexico, and there is a pair from the Runyon catch, southwestern Arizona or southeastern California, in the Academy Collection.

The species is like *trifasciatus* Hewitson, and it is possible that it is but a form of that species, though Godman and Salvin consider it to be distinct.

They state there is a pale and a dark form of *trifasciatus* flying together at the same time of year in tolerably equal numbers. Hewitson described one of the former and Godman and Salvin figure one of the latter.[33]

Our limited series shows the dark form from Paraguay and Brazil, and the pale form from Mexico and Cuba.

*Ruptifasciatus* is similar, but the distinct oblique bands of the primaries of *trifasciatus* are in this species or form replaced by indistinct and rather irregular macular bands, and those of the secondaries are broken up into spots.

The Godman and Salvin figure of the genitalia agrees with that of our specimens of *trifasciatus*. We figure a *ruptifasciatus* presumably from northern Mexico, and agreeing with the Runyon pair.

The tegumen is asymmetric, the hooded portion somewhat different on the two sides; the scaphium well developed on the left side is only a linear arm on the right; the sides of the girdle are not of the same width; the saccus is a mere ring; the right valve ends in a fan-shaped process one side of which is bent at right angles to the other in nature, and there is a conspicuous rod at the base (this rod spatulate in our examples of *trifasciatus*); the left valve ends in a process different from that of the right valve and the rounded ventral outer margin is slightly dentate (strongly serrate in *trifasciatus*); the aedoeagus is simple, long and slender.

30. **Grais stigmaticus** Mabille (Fig. 30.)

Biol. Cent.-Amer., Rhopalocera, pl. 85, fig. 26, (1894).

This species lacks the costal fold. It is a tropical type, crossing the border into Texas.

The uncus ends in a single beak, broad, swollen above, lobed on the sides below, and bearing a tooth on each side at the base; the scaphium is well developed, smooth; the aedoeagus carries a sponge-like mass of hairs.

[33] Pl. 88, figs. 1 and 2.

# SYSTEMATIC AND BIOLOGICAL NOTES ON BUMBLEBEES (BREMIDAE; HYMENOPTERA)

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The present paper is the result of a study of a series of bumblebees in the collection of the author from Arizona, several specimens in the collections of the United States National Museum and the Biological Survey, and the entire collection of North American bumblebees of the Academy of Natural Sciences of Philadelphia and the American Entomological Society. To Mr. E. T. Cresson, Jr., Dr. Henry Skinner and Mr. J. A. G. Rehn, I owe my sincere thanks for their many courtesies and the privilege of studying in detail the types and collection of some twenty-eight hundred bumblebees belonging to the American Entomological Society. I am also under obligations to Mr. S. A. Rohwer for the loan of and notes on several specimens belonging to the United States National Museum, and to Mr. Henry L. Viereck for the loan of specimens from the collection of the Biological Survey.

For the sake of convenience and because of the nature of the subject matter itself, I have deemed it advisable to divide this article into five parts.

## A. Descriptions and Notes on Bumblebees from Arizona

Prior to 1913 only seven species of *Bremus* and no species of *Psithyrus* were known from Arizona. Recently in Entomological News,[1] I recorded five species and one subspecies of *Bremus* and one species of *Psithyrus* which were additions to the list of this state. This increased the number of Bremidae known to occur in Arizona from seven to thirteen species. When this article was sent to press, I had some other bumblebees from the same state, which I hesitated to report upon at that time because of doubt as to their specific status. Further study has shown these specimens to represent two new varieties of *Bremus kirbyellus*

[1] XXXII, pp. 144–148, (1921).

(Curtis), and one new variety of *Bremus sylvicola* (Kirby), both species being new records for Arizona.

**Bremus kirbyellus** var. **alexanderi** new variety

Queen and worker.—Taxonomically almost identical with the typical *kirbyellus* (Curtis), which occurs in regions farther north. Differs slightly in structure from the typical queens of *kirbyellus* that I have studied, by having a comparatively shorter malar space, a condition particularly noticeable in the worker caste. Yellow pile of mesopleura not extending to the base of the legs, and with pile on posterior margin of this area entirely black. Metapleura and medium segment with black pile. Posterior margin of the fourth together with the entire fifth dorsal abdominal segment ferruginous, and also the sixth dorsal abdominal segment in the workers. Legs and ventral portions of the body black, except that the tips of some of the setae bordering the corbicula have a slight ferruginous tinge, particularly pronounced in the case of some workers. Coloration otherwise as in typical specimens of *kirbyellus*.

*Holotype*.—queen, July 11, 1917, Patagonia Mountains, Arizona. *Paratopotype* queen, July 13, 1917. *Morphotype* worker, July 14, 1917, Patagonia Mountains, Arizona. *Paratopotype* workers, one collected July 11, 1917, three on July 13, 1917, and one on July 14, 1917. One *paratype* worker, June 5, 1917, Oracle, Arizona. All the specimens collected by Mr. E. J. Oslar.

One paratopotype worker deposited in the collections of each of the following institutions: American Entomological Society, American Museum of Natural History and the United States National Museum. Holotype and remaining paratype specimens in the collection of the author.

Named in honor of my friend Dr. C. P. Alexander, to whom I am indebted for many favors.

The male of this variety will undoubtedly be obtained in future collections from this region, a caste which may necessitate the elevation of this form from varietal to specific rank. In many respects *B. kirbyellus alexanderi* resembles also *B. polaris* (Curtis), another species of the same group, and if the specimens were from Arctic America might readily pass as that species. I have deemed it advisable to describe my specimens as a variety of *kirbyellus* because this species is found in the high mountain ranges of the western United States, whereas *polaris* is only known from Greenland, Labrador, Alaska and other far northern

localities. The capture of the at present unknown male of variety *alexanderi* will settle this question as to its relationship with *polaris* and *kirbyellus*, as the males of these latter two species are readily separated by genitalic characters.

**Bremus kirbyellus** var. **arizonensis** new variety

Queen.—Similar in all respects to *kirbyellus* var. *alexanderi* except that the pubescence on the apical dorsal abdominal segments is entirely black, the scutellum is not so strongly yellow, the yellow pile on the mesopleura extends only half way down the bases of the wings to the bases of the legs, and the malar space is slightly shorter.

*Holotype*.—queen, July 11, 1917, Patagonia Mountains, Arizona. Collector, E. J. Oslar.

The holotype queen of this melanic variety is in the collection of the author.

The status of variety *arizonensis* is the same as that of variety *alexanderi*, and for the same reasons as in the case of the latter variety has been treated as most closely related to *kirbyellus*. Variety *arizonensis* will run to *hyperboreus* Schönherr (= *aretieus* Kirby) in Franklin's key to the bumblebees published in 1913, a species restricted to the northern parts of Eurasia, Greenland and the extreme northern portions of North America. Thus a striking example of color homomorphism in different species from widely separated regions is presented. These two bumblebees are distinctly separated by the great difference in the length of the malar space.

**Bremus sylvicola** var. **lutzi** new variety

Queen.—Taxonomically almost identical with the typical *sylvicola* (Kirby) found in Alaska and the far northern regions. Face in two specimens black, in four specimens with a slight amount of yellow pile on the very middle portion. Occiput with varying amounts of dark and yellow pile, the dark pile dominating in most specimens. Yellow pile on the pleura of the thorax not extending to the bases of the legs and in most specimens but half way down from the bases of the wings to the bases of the legs. First dorsal abdominal segment yellow, except basal middle portion which often has some black pile; second and third segments ferruginous, with some black pile on their middle portions; fourth segment yellow with black pile on the middle portion; fifth and sixth segments almost entirely black.

*Holotype*.—queen, July 11, 1917, Patagonia Mountains, Arizona. Five *paratopotype* queens, July 11, 13 and 14, 1917, Patagonia Mountains, Arizona. All the specimens collected by Mr. E. J. Oslar.

One paratopotype queen deposited in the collections of each of the following institutions: American Entomological Society, American Museum of Natural History and the United States National Museum. Holotype and remaining paratopotype queens in the collection of the author.

I name this variety for my friend Dr. F. E. Lutz, who has done a great deal to increase our knowledge of the bumblebees.

Variety *lutzi* differs from the typical *sylvicola* from Alaska, northern Canada and Labrador, as described by Franklin, as follows: the face is dominantly black as well as the lower half of the mesopleura, the metapleura, and the median segment. The black pubescence on the middle dorsal area of segments two, three and four is often so pronounced as to form a distinct longitudinal band, sharply dividing the dominant yellow and ferruginous pubescence of these segments. The yellow pile is of a duller hue than in most specimens of *sylvicola* that I have studied from Alaska, Canadian Northwest Territories and Labrador. In several specimens of variety *lutzi* the pile on the fourth dorsal abdominal segment is whitish. Another difference between the typical *sylvicola* and variety *lutzi* is that in the former the fifth dorsal abdominal segment usually has some yellow pile, whereas in the latter this segment is entirely black or mainly so. Variety *lutzi* also differs from the melanic variety *johanseni* Sladen of *sylvicola*, described in 1919, in having a greater amount of yellow pile on the upper portion of the pleura of the thorax, and the fourth dorsal abdominal segment being largely yellow. Variety *johanseni* is known only from the type localities of Bernard Harbour, Northwest Territories, Coronation Gulf and Herschel Island, Yukon Territory.

I am considering *lutzi* to be a variety of *sylvicola* on the basis of the color pattern and structural characters presented by the queens. There is a possibility, however, that *lutzi* may prove to be a southern species of the *sylvicola* complex. Males are needed to decide definitely this problem of systematic position.

The presence of a variety of *sylvicola* or a member of the *sylvicola* complex in Arizona extends considerably the southward range of this species, and reopens the discussion as to the presence of *sylvicola* in the United States. The first record of this species from the United States is that of Cresson in 1879, when he listed

this bumblebee from Colorado. Since then both Cockerell and Titus have listed this species from the same state. Franklin omits Cockerell's record of 1893, but Lutz and Cockerell have assigned this record to *melanopygus* Nylander. Franklin disposed of the 1902 record of Titus as questionably referring to *melanopygus*, and says that *sylvicola* "does not appear to be present in the United States and is strictly a Boreal form." The same record was also questioned by Cockerell in 1907, when he stated that he believed the apex of *sylvicola* was not black, the alternative through which it was keyed by Titus. The apex of *sylvicola*, however, is black or mainly so, which is an indication that the record of Titus is correct. Titus states that all his specimens of this species were identified for him by Ashmead, and that "It is certainly a distinct high Alpine species." The case in proof of the correctness of the record by Titus is also strengthened when we consider that Ashmead in the same year published his account of the Hymenoptera of Alaska. Though Ashmead frequently confused certain species of bumblebees, he correctly distinguished some specimens of *melanopygus* and *sylvicola* in this Alaskan collection, as Franklin indicates in his species bibliography and a personal study of some of these specimens shows. Therefore, it seems reasonable to suppose that he did not incorrectly identify the same species from Colorado specimens. In 1911, Friese gave the varietal name *flavicollis* to a species he called *lapponicus* from Pike's Peak, Colorado. Lutz and Cockerell consider *flavicollis* to be a variety of *sylvicola*, the nearest relative of *lapponicus* in North America. Recently, I had the opportunity to study two specimens of *sylvicola* belonging to the American Museum of Natural History. Both of these specimens were obtained by the Museum from Friese and labeled by him *lapponicus* var. *flavicollis*. As these two specimens prove to be nearly typical *sylvicola*, the use of *flavicollis* as a varietal name is questionable. One of the specimens is from Labrador and the other from Pike's Peak, Colorado, the type locality of *lapponicus* var. *flavicollis* Friese. In the bumblebee collection of the Bureau of Biological Survey there are many specimens of *sylvicola*, collected in Colorado at high altitudes by Mr. L. O. Jackson. I possess three workers and two males of

this species collected by Mr. E. J. Oslar at San Miguel and Clear Creek, Colorado. In the collection of the American Entomological Society are queens of this species which are from Colorado, and it is likely that these are the specimens on which Cresson's record of 1879 is based. In view of the records just given, the occurrence of a variety of *sylvicola* in Arizona is not remarkable, and the species probably occurs in most of the high mountain ranges of the western United States.

**Bremus pleuralis** Nylander

This species is represented from Arizona by one queen, collected by Mr. E. J. Oslar, in the Patagonia Mountains, Arizona, on July 11, 1919.

I have carefully compared this specimen with queens and workers of *pleuralis* in the United States National Museum and the American Entomological Society, collected by T. Kincaid on the Harriman Alaskan Expedition of 1899. In coloration, except for the triangular patch of black hairs extending downwards on the basal dorsal portion of abdominal segments one and two, and the more yellow scutellum and mesopleura, it reminds one of *kirbyellus* var. *arizonensis*. Structural differences, such as the carinate hypopygium, length of the malar space, and strictly tridentate type of mandibles, readily serve to distinguish *pleuralis* from *kirbyellus* var. *arizonensis*. Cockerell's record of *pleuralis* from the northern peninsula of Michigan in 1916 is certainly wrong. His statement that the specimen he questionably determined as *pleuralis* cannot be a melanic variety of *B. consimilis* [= *vagans*], because of "the malar space being too short," likewise prohibits it from being *pleuralis*. In *pleuralis* the malar space is comparatively almost as long as that of *vagans*. Cockerell says also that the general coloration of the specimen is like that of *vagans*, whereas *pleuralis* usually has a triangular patch of black pile on the dorsal middle portion of abdominal segments one and two, a condition not encountered in *vagans*. I have studied a large series of bumblebees from various parts of Michigan, and am inclined to believe that the *pleuralis* listed by Cockerell from that state is a worker of the variable and oftentimes puzzling bumblebee so well named *perplexus* by Cresson. The melanic condition referred to, the "general coloration" of *vagans* and the "abdomen entirely

black-haired beyond the second segment," as well as statements relative to the length of the malar space, all strengthen my supposition that Cockerell's Michigan record is to be referred to *B. perplexus*. *B. perplexus* is very common in the northern parts of Michigan and, strange to say, is not recorded by Cockerell along with the other bumblebees common to that general region. Varieties of *rufocinctus* Cresson occasionally approach *vagans* and *perplexus* in coloration, but the extremely short malar space, the tendency of the hypopygium to be carinate and the position of the ocelli are all characters which serve to distinguish *rufocinctus* under such conditions. Cockerell mentions that the malar space of his specimen is longer than that of *affinis* Cresson, which indicates that it is not *rufocinctus*. The hypopygium of *pleuralis* likewise has a pronounced carina, a character not mentioned by Cockerell as possessed by his Michigan specimen.

According to Mr. Oslar, the bumblebees labelled "Patagonia Mountains, Arizona," were found feeding on the blossoms of wild blackberry and mesquite at altitudes from 5,500 to 6,000 feet. The presence of members of the *Kirbyellus* Group in Arizona, as recorded above, gives that state representatives of all the known American Groups of *Bremus* and one of the three American Groups of *Psithyrus*. This state has therefore a varied bumblebee fauna, which is correlated with the diverse ecological conditions existing in various parts of the state. Because of the occurrence of so many species of true bumblebees, other species of the genus *Psithyrus* besides *crawfordi* Franklin will undoubtedly be found there.

## B. The Description of the Worker and Male of Bremus franklini Frison, and the Correct Synonymy of Psithyrus kodiakensis Ashmead

**Bremus franklini** Frison

This species was originally described in the Entomological News for 1921, from two specimens of the queens, both collected at Nogales, Arizona. Since then, I have had the opportunity of studying specimens belonging to the United States National Museum which I consider to be the other castes of this species.

Worker.—Face with black and whitish-yellow pile intermixed, the black pile dominant. Occipital orbits dark, somewhat coarsely and densely punctate. Occiput with a triangular patch of nearly pure whitish-yellow pile. Labrum with tubercle-like areas large and well separated, coarsely punctate; shelf-like projection about one-third as broad as labrum; pile on anterior margin ferruginous. Mandible four-toothed, with numerous minute coarse scattered punctures; setae on distal portion short, on lower proximal margin long, ferruginous. Clypeus well punctate, particularly so in anterior and posterior corners. Malar space somewhat shorter than its width at articulation of mandible, about one-half as long as greatest width of and one-fifth length of eye, nearly impunctate, polished. Ocelli situated just above the narrowest part of the vertex; lateral ocelli as far distant from each other as distant from inner margin of the eye; area just laterad of lateral ocelli impunctate, polished, but becoming well punctate again near inner margin of the eye. Flagellum about one and three-fourths times as long as the scape; third antennal segment longer than the fifth, the fifth a trifle longer than the fourth.

Thorax with dorsal cephalic portion covered with pure yellow pile, the yellow pile extending (except for a little black pile on the middle of its posterior border) caudad to the cephalic margin of the scutellum. Scutellum with pure black pile. Disk of mesonotum bare, impunctate and polished. Mesopleura, except for the yellow pile of dorsum slightly extending down below the level of the bases of the wings, black. Pile on the metapleura and propodeum black.

Abdomen with the pile on the first four dorsal segments entirely black, the fifth and sixth dorsal segments with a slight touch of light pile on their lateral margins. Venter brownish-black. Hypopygium without a median carina.

Legs black, but with some light ferruginous short setae on tarsal segments. Corbicular fringes black. Hind metatarsi distinctly arcuate.

Wings very dark, with a slight violaceous reflection.

Length, 14 mm.; spread of wings, 31 mm.; width of abdomen at second segment, 7 mm.

*Morphotype* worker, Oregon. (Collector, C. F. Baker.) Deposited in the collection of the United States National Museum.

Male. Face with pure yellow pile below and with intermixed black and whitish-yellow pile above the articulation of the antennae. Occipital orbits mostly with dark pile, but that on posterior portion somewhat yellowish, coarsely and densely punctate. Occiput with a triangular patch of pure light yellow pile. Malar space slightly longer than its width at articulation of mandible, about one-half as long as greatest width of and one-fourth length of the eye. Ocelli situated just above the narrowest part of the vertex; lateral ocelli as far distant from each other as from the inner margin of the eye. Flagellum about two and two-thirds times as long as the scape; third and fifth antennal segments subequal in length, the fourth much shorter than either.

Thorax with dorsal cephalic portion covered with pure yellow pile, the yellow pile extending (except for a little black pile on the middle of its posterior border) caudad to the cephalic margin of the scutellum. Scutellum with pure black pile. Disk of the mesonotum bare, impunctate and polished. Mesopleura, except for the yellow pile of dorsum slightly extending down below the level of the bases of the wings, black. Metapleura and propodeum with black pile.

Abdomen with pile on the first four dorsal segments entirely black; fifth, sixth and seventh segments with anterior portion black and posterior portion (particularly the sixth and seventh segments) a pale brownish-yellow. Venter brownish-black, with light pile particularly noticeable on the posterior margins of the second, third and fourth segments. Genitalia of the same general type as in the other members of the *Terrestris* group (Radoszkowski) in the United States.

Legs mostly black, but with a large number of short ferruginous setae on the tarsal segments and a slight amount of long light pile on the trochanters and hind femora. Outer aspect of hind tibia slightly convex, smooth, polished; corbicular fringes black, slightly tinged with ferruginous at distal ends.

Wings very dark, with a slight violaceous reflection.

Length, 15 mm.; spread of wings, 35 mm.; width of abdomen at second segment, 7.5 mm.

*Allotype*.—male, Oregon. (Collector, C. F. Baker.) Deposited in the collection of the United States National Museum.

The discovery of the male and the worker castes of *Bremus franklini* Frison confirms my previous supposition, based on the characters presented by the queen, that this species is a member of the *Terrestris* Group (Radoszkowski) and most closely related to *Bremus occidentalis* Greene. It may readily be separated from the latter species, as pointed out in Entomological News of 1921,[2] by the marked differences in the color pattern of the thorax, apical abdominal segments, whitish-yellow pile of the occiput, violaceous wings and darker corbicular fringes. Though *Bremus franklini* was described from Arizona, I am regarding the male and worker described here as being this species on the basis of the close agreement in structural and colorational characters. The absence of specimens of this species in the very large series of bumblebees I have examined in various collections, indicates that *Bremus franklini* is one of our rarer species of this widely distributed genus.

**Bremus kirbyellus** (Curtis).

In 1902, Ashmead in the Proceedings of the Washington Academy of Sciences described two male bumblebees under the name

[2] Page 48.

of *Psithyrus kodiakensis*. Since that time the true status of this species has remained in doubt and has caused considerable confusion. Franklin in 1912 considered *P. kodiakensis* as the male of *Bremus kincaidii*, described by Cockerell from the Pribilof Islands, in 1898. In a recent paper on the "Hymenopterous Insects of the Family Bremidae from the Pribilof Islands, Alaska," 1921, I questioned the correctness of the synonymy as given by Franklin, based on the geographical distribution of the two forms in question, and the lack of additional records for *kincaidii* in Alaska. In a still later paper in the Entomological News for 1922, I reported on a study of the male of *kincaidii* from a specimen collected on St. Paul Island of the Pribilof Group. As there is every evidence to believe that only one species of bumblebee occurrs on the Pribilof Islands, this specimen was extremely valuable to me from a comparative standpoint. More recently still I have made a detailed study of the paratype male of *kodiakensis* and drawings of the claspers of the type male, and compared these with a male of *kincaidii* from the Pribilof Islands. Both the type and paratype males prove to be *kirbyellus* (Curtis), a species of common occurrence in Alaskan collections, and therefore *kincaidii* is still to be considered as endemic to the Pribilof Islands. Dr. G. Dallas Hanna even presents evidence to show that the latter species is "confined solely to St. Paul Island of the Pribilof Group." I know of no other species of bumblebee with such a restricted distribution. Confusion concerning the true status of what Ashmead named *kodiakensis* has been due, no doubt, to the fact these specimens are somewhat aberrant in color from the usual type of *kirbyellus*. Structural differences are available, however, in this instance for a correct conception of the species. Lutz and Cockerell in their recent check-list also deem it probable that *kodiakensis* is synonymous with *kirbyellus* and not *kincaidii*.

## C. Changes in Nomenclature and Synonymy based principally on a Study of Specimens and Types in the Collections of the Academy of Natural Sciences of Philadelphia and the American Entomological Society

**Bremus polaris** (Curtis) and **hyperboreus** (Schönherr)

In the Proceedings of the Academy of Natural Sciences for 1892, Mr. William J. Fox published a report on some Hymenop-

tera collected in West Greenland. In this paper *B. nivalis* (Dahlbom), *B. hyperboreus* (Schönherr), *B. derhamellus* (Illiger) and *Bremus* species are recorded. A careful study of these specimens establishes the fact that all of them belong to two species, *hyperboreus* and *polaris* (Curtis). Lutz and Cockerell (1921) wrongly placed under *B. frigidus* (F. Smith) Fox's record for *derhamellus* from Greenland. Franklin undoubtedly overlooked this record as he makes no mention of the same. Accordingly, the specific name *derhamellus*, which applies to a European species not a member of our fauna, can be stricken from our American list. The record of *nivalis* by Fox was doubtfully considered by Franklin, in 1912, as pertaining to *kirbyellus*, but all of the specimens studied by Fox belong to *polaris* with the exception of the specimens of *hyperboreus*. The results of my study of these Greenland species is quite in keeping with my opinion that only two species of bumblebees occur in Greenland, namely, *hyperboreus* and *polaris*. The European references to *kirbyellus* as present in Greenland probably all refer to *polaris*. Whether the form we call *kirbyellus* from the northern regions and high altitudes, and which has a more westerly distribution than *polaris*, is identical with the species listed by the same name in Siberia and northern Europe remains for future solution.

**Bremus edwardsii** (Cresson) and **bifarius** (Cresson)

In his monograph of the bumblebees, in 1912, Franklin placed *B. bifarius* (Cresson) in the synonymy of *B. edwardsii* (Cresson). A thorough study of the lectotype worker of *edwardsii* from California, as well as several workers and allotypes from the same locality, prove this to be the form Franklin described as new under the name of *B. fernaldi*. The name *edwardsii* should therefore be the name used for the species redescribed by Franklin, as it has priority. Likewise, because of this change, the name *bifarius* must be adopted for the species Franklin lists as *edwardsii*.

Several characters are present in the lectotype worker of *edwardsii* which prohibit it from being considered the same as Cresson's type of *bifarius*. The posterior border of the black band between the wings is straight, the corbicular fringes are black, the malar space is proportionally longer than in *bifarius*,

and there is a slight difference in the shape of the hind metatarsus. The points of difference just stated are the points of difference existing between Franklin's *fernaldi* and what he calls *edwardsii*. It is also desirable to add that the allotype males of *edwardsii* have longer antennae than do males of *bifarius* and that they exhibit also a slight difference in the form of the genitalia. This difference in the length of the antennae is also apparent in Franklin's description of *fernaldi* and *edwardsii*. There is a variety of *bifarius* which closely resembles what must now be called *edwardsii* (= *fernaldi* Franklin), which was described as *nearcticus* by Handlirsch in 1888. Undoubtedly this has been the cause of the present confusion. It is very probable that Cresson mixed the variety *nearcticus* of *bifarius* with his own species *edwardsii*, as he gives the distribution of *edwardsii* as California and Colorado. I have never seen a specimen of true *edwardsii* from Colorado. In this connection it may be noted that Fowler listed *edwardsii* from California, and that Franklin later considered this record as pertaining to his species *fernaldi*. In the light of the present evidence, Fowler determined this species correctly.

**Bremus flavifrons** (Cresson)

A study of the lectotype male and paratype male of *B. flavifrons* (Cresson), both of which bear the label "R. A." (Russian America), shows that neither specimen is the same as the species now going by the name of *flavifrons* and answering the description of that species as redescribed by Franklin in 1912. Instead, these specimens are males of *B. pleuralis* (Nylander). Both these last-named species and *B. centralis* (Cresson) are very closely related, but sufficiently distinct to be considered as species. The presence of a definite black band between the wings is a decided characteristic of *pleuralis*, as well as the pure yellow character of the pubescence anterior to the black thoracic band. On specimens which I consider to be males of *flavifrons*, the anterior dorsal part of the thorax bears a mixture of black and yellow pubescence; thus agreeing in this respect with the queens and workers of the same species. The paratype male also has a considerable amount of ferruginous pubescence on the fifth dorsal segment, a condition which occurs in a male

variety of *pleuralis* from Alaska. The specimens described as *alaskensis* and *dimidiatus* by Ashmead in his report on the Hymenoptera taken by the Harriman Alaskan Expedition in 1902 are, as stated by Franklin, the species called *flavifrons*. I wish, however, to recognize Ashmead's name *dimidiatus* as a varietal name for the specimens of this species lacking ferruginous pubescence on the third and fourth dorsal abdominal segments.

The fact that the male selected as the lectotype of *flavifrons* belongs to another species is unfortunate, but does not offer sufficient grounds for considering *flavifrons* as synonymous with *pleuralis*. Cresson's original description of the queen of *flavifrons* in 1863, certainly applies to the species we have been calling *flavifrons*. His description of the male, which follows the descriptions of the queen and worker, indicate, however, that it was based upon specimens of *pleuralis*. As there is no means of proving that the lectotype and paratype males bearing the label "R. A." are from the type locality, "Ft. Youcon, Arctic America," it is advisable to retain the name *flavifrons*.

The determinations of males belonging to the above species has been a constant source of perplexity to persons engaged in the determination of bumblebees. In this connection it seems well to note that the presence of a sharply defined black band on the dorsum of the thorax between the wings in a male of this complex denotes *pleuralis;* a mixture of black and yellow pubescence on the anterior dorsal portion of the thorax, *flavifrons;* dorsum of thorax mostly pure yellow, except for a very poorly defined black band between wings, *centralis;* and *sitkensis* as described by Franklin. The length of the malar space in all castes is longer in *flavifrons* than in *centralis*.

A study of two cotype workers of *B. ambiguus* (Franklin) convinces me that *ambiguus* is merely a slight color variety of *flavifrons*. The malar space in both cotypes is considerably longer than the length of the malar space in specimens of *sitkensis* (Nylander), thus agreeing in this respect with *flavifrons*. Franklin considered *ambiguus* as most closely allied to *sitkensis*. It is to be noted also that the pubescence of *ambiguus* is short, another attribute of *flavifrons*. In *sitkensis* the pubescence is

very long and shaggy. The arrangement of the setal punctures about the ocelli also bears out the view of the closer affinity of *ambiguus* with *flavifrons* as compared with *sitkensis*, in fact so closely do the two agree that I consider *ambiguus* to be but a color variety of *flavifrons*.

Studies of representatives of all North American species of the Pratorum Group show that *centralis*, *flavifrons*, *pleuralis* and *sitkensis* form a small complex of their own within this large, quite generally distributed group.

**Bremus americanorum** (Fabricius)

There has been repeated discussion concerning what species of bumblebee DeGeer described, in 1773, by the name *pennsylvanicus*. Franklin came to the conclusion that *americanorum* of Fabricius (1775) was synonymous with *pennsylvanicus*, the latter having priority. The correctness of this interpretation has recently been questioned by Robertson (1920) and *americanorum* is the name now used by Lutz and Cockerell (1920). A careful study of DeGeer's description and figure, and the arguments pro and con, convinces me that DeGeer described the species we are now calling *fervidus*. The fact that the scutellum is stated by DeGeer to be yellow, and is so illustrated, is an argument in favor of *pennsylvanicus* being synonymous with *fervidus*. Franklin has called attention to this, but adds that such a condition is sometimes found in specimens of *auricomus* (Robertson) and *americanorum*. This, however, is the exception and not the rule. The same type of argument on the basis of color characters might be used to refute some of the views advanced by Franklin that the species is not *fervidus*. In DeGeer's description he stated in one place that the abdomen is entirely yellow above, except at its extremity where the last segments are black. If the yellow pubescence of the abdomen was restricted to but a portion of the first and the entire second and third dorsal abdominal segments, why such a statement as this? Franklin says the figure "represents a female with the black pile running up on the mesopleura nearly to the level of the bases of the wings," and accordingly the species can not be *fervidus*. It seems to me that the figure shows the basal segments of the legs drawn up rather closely to the body, and as

these are black the true color of the mesopleura is obliterated, and instead the black of the legs is depicted. I see no more justification for assuming DeGeer's species to be *auricomus* than for calling it *pennsylvanicus*.

However, because of the fact that there is no absolute certainty as to which species *pennsylvanicus* refers, without recourse to the type, I have adopted the term *americanorum* for what Franklin calls *pennsylvanicus*. This is the position taken by Lutz and Cockerell, "as the identity of the latter [*pennsylvanicus*] is too uncertain."

**Psithyrus fernaldae** Franklin

When Franklin first described this species of *Psithyrus*, in 1911, he described also in the same article a male of *Psithyrus* by the name *tricolor*. At this time Franklin thought it very probable that *tricolor* was the male of *fernaldae*, as he says "I am strongly of the opinion that *fernaldae* is the female of *tricolor*." There were several reasons for this assumption. In the first place, both *tricolor* and *fernaldae* were in many ways structurally unique among the other *Psithyrus*. In both cases the opposite sex was unknown, a condition which might readily be interpreted to indicate that they were the same species, but opposite sexes. Again, the distribution of *tricolor* and *fernaldae* corresponded in many places. In some localities, however, one form was known and not the other, and Franklin particularly stresses the fact that "*tricolor* has been taken in Colorado while *fernaldae* has not." Recently I found a specimen of *P. fernaldae* from Colorado in a collection of bumblebees sent me for study by Mr. H. L. Viereck. This specimen was collected at Duck Lake, Grant, Colorado, on July 17, 1916, at an altitude of 11,000 feet, by Mr. L. O. Jackson. In view of this record and the additional ones given in another part of this paper, it seems advisable to drop the name *tricolor* and consider this male as the opposite sex of *fernaldae*.

**Psithyrus insularis** (F. Smith)

In 1920, Bequaert listed both *P. insularis* and *P. consultus* Franklin, from Alaska. In this connection the statement of Franklin that *consultus*" is most probably the male of *P. insularis*" was mentioned. In 1915, Sladen published a short

article recording the capture of *P. insularis* in a nest of *Bremus flavifrons* (Cresson). As males of *P. consultus* were found in this nest, ample evidence was provided that *consultus* was the male of *insularis*. Lutz and Cockerell (1921) have wisely dropped the name *consultus* and list under *insularis* all records referring to the former species.

**Psithyrus variabilis** (Cresson)

A specimen contained in the collection of the Academy of Natural Sciences of Philadelphia presents evidence that *P. bicolor* Cockerell is but a color variety of *P. variabilis* (Cresson). The specimen in question is a female and was collected on June 16, 1902, at Clouderoft, New Mexico, by H. L. Viereck. This specimen will run to *bicolor* in Franklin's key to the females of *Psithyrus*, because of the presence of some yellow pubescence on the fourth dorsal abdominal segment. According to the descriptions of *bicolor* and *variabilis* the only difference between them is that the former has some yellow pubescence on the dorsum of the abdomen. Cockerell's description was based on one female. It is interesting to note that this female was collected at Rociada, New Mexico, and has never been found elsewhere. Males of *variabilis* very frequently possess a considerable amount of yellow pubescence on the dorsum of the abdomen. I have also seen females of *variabilis* from Illinois which had a slight amount of yellow pubescence on the dorsum of the abdomen. The fact that I can find no structural difference between this specimen from New Mexico and *variabilis*, convinces me that *bicolor* is merely a color variety of *variabilis*.

## D. A New Species from Borneo

**Bremus folsomi** new species

Queen. Face, occiput and cheeks with brownish-black pile. Labrum moderately punctate; tubercle-like areas large, slightly shagreened, with the space between them equal to the length of the second flagellar segment; shelf-like projection broad; pile on anterior margin bright golden in color. Mandible distinctly four-toothed, the fourth tooth, however, much less developed than the others; setae on the distal portion between the longitudinal ridges very short, dense and bright golden in color, that on the lower proximal portion very long and of the same color as the short setae. Clypeus with numerous small punctures on the disk, and large scattered punctures mixed

with smaller ones on the lateral, dorsal and anterior portions. Malar space slightly shorter than its width at articulation of mandibles, about two-thirds the greatest width of and one-fourth the length of the eye. Ocelli situated slightly above the narrowest part of the vertex; lateral ocelli almost as far distant from each other as from inner margin of eye; area between lateral ocelli and eyes polished, impunctate except for a very few small punctures near inner margin of eye. Flagellum about twice as long as the scape; third antennal segment somewhat longer than the fifth, the fifth slightly longer than the fourth.

Entire dorsum and pleura of thorax, except for the small polished and impunctate disk, covered with moderately long tawny-yellow pile.

Abdomen with the first dorsal segment yellow, the pile being short and sparse on the middle portion; second dorsal segment with dull ferruginous pile on the sides and yellow in the middle; third, fourth and fifth dorsal segments with dull ferruginous pile; sixth dorsal segment with short brownish-black pile. Venter with golden and brown pile fringing posterior margins of the segments. Hypopygium without a median carina.

Legs black, but with the pile on the ventral surfaces of the femora and a portion of the tibiae dull golden or ferruginous. Corbicular fringes both on the dorsal and ventral margins bright ferruginous. Hind metatarsi distinctly arcuate.

Wings pale brown, the nervures distinctly outlined in darker brown.

Length, 20 mm.; spread of wings, 39 mm.; width of abdomen at second segment, 10 mm.

*Holotype.*—queen, Kina Balu, British North Borneo.

The *holotype*, No. 10542, is in the collection of the Academy of Natural Sciences of Philadelphia.

*Bremus folsomi* is the first species of bumblebee to be found in Borneo. The discovery of a species of this genus at Kina Balu, however, is not surprising as bumblebees are known from Java, Sumatra and the Philippine Islands (Luzon, Mindanao and Negros).

I name this species for my friend Dr. J. W. Folsom, who first interested me in the study of the bumblebees and has assisted me in many ways.

## E. New Distributional Records

The following new distributional records, unless otherwise noted, are based upon specimens contained in the collections of the Academy of Natural Sciences of Philadelphia and the American Entomological Society.

1. *Bremus terricola* (Kirby). Montana, one queen. Not previously recorded from the United States west of North

Dakota. The presence of this species in Montana is not surprising when the records of its distribution in North Dakota, Saskatchewan, and Alberta are considered.

2. *Bremus affinis* (Cresson). Virginia, one queen and seven workers; West Virginia, two workers and two males; Illinois, one male. Franklin lists this species from Virginia and West Virginia in his geographical table, but it is not clear from his remarks whether it had actually been found there. In 1919, the writer expressed the view this species would be found in Illinois. The existence of this male confirms this supposition and makes a total of sixteen Bremidae now recorded from Illinois.

3. *Bremus affinis* var. *novae-angliae* (Bequaert). West Virginia, one male; Grandfather Mt., North Carolina, one male, September 11, 1908, 2500–3000 feet altitude (Z. P. Metcalf). The occurrence of this variety in these two states is interesting, as the variety was formerly only known from Massachusetts and New York.

4. *Bremus borealis* (Kirby). Volga, South Dakota, two workers.

5. *Bremus rosnesenskii* (Radoszkowski). Montana, one queen. This is a very small specimen.

6. *Bremus perplexus* (Cresson). Illinois, one worker. Listed by myself, in 1919, from Illinois on the basis of the record furnished me by the late Mr. O. S. Westcott. This is the first specimen of this species I have seen from Illinois.

7. *Bremus ternarius* (Say). Montana, one queen. This species has been repeatedly confused with *B. huntii* (Greene) in the western states, but the present specimen is without doubt *ternarius*. The fact that *ternarius* is also known from the Dakotas, Saskatchewan and Alberta helps explain the distribution in the present instance.

8. *Bremus frigidus* (F. Smith). Thunderhead Mountain, 6,000 ft. altitude, Blount County, Tennessee, one female, August 4, (H. A. Pilsbry). This species presents a very scattered distribution and is evidently one of the rarer forms throughout its range.

9. *Bremus vagans* var. *sandersoni* (Franklin). Baraga County, Michigan, one queen, July 20, 1903, (Morgan Hebard); Pequaming, Michigan, one queen, July 3, 1903, (Morgan Hebard).

10. *Bremus americanorum* (Fabricius). Nova Scotia, four queens.

11. *Bremus auricomus* (Robertson). Volga, South Dakota, two queens and one worker; Georgia, one queen; Miami, Florida, one worker, (P. Laurent).

12. *Bremus nevadensis* (Cresson). Condor, Oregon, one queen, July 5, 1899.

13. *Bremus fraternus* (F. Smith). Volga, South Dakota, one worker.

14. *Bremus morrisoni* (Cresson). Trego County, Kansas, three workers, July 12, 1912 (Williams). Specimens in the collection of the University of Kansas.

15. *Bremus impatiens* (Cresson). Douglas County, Kansas, two workers, October, (F. H. Snow); Douglas County, Kansas, one queen, May; Lawrence County, Kansas, one queen, May 5, 1911, (F. X. Williams). All specimens in the collection of the University of Kansas. Mr. E. S. Tucker recorded *B. impatiens* by the name *B. virginicus* from Lawrence, Kansas, in 1909, as listed by Lutz and Cockerell (1921). Franklin apparently overlooked this record. The present records are given merely to substantiate the occurrence in Kansas of this species.

16. *Bremus bimaculatus* (Cresson). Chatauqua County, Kansas, one queen and three workers, 1916, (Beamer); Douglas County, Kansas, four workers, July 5–August 12, 1919, (Hoffman); Douglas County, Kansas, fifteen males, July 29–30, 1919, (Hoffman). Specimens in the collection of the University of Kansas.

17. *Psithyrus insularis* (F. Smith). Duluth, St. Louis County, Minnesota, two males, August 6–8, 1912, (Witmer Stone); Shore of Keweenaw Bay, Pequaming, Michigan, one queen, July 9, 1903, (Morgan Hebard); Regua, California, one male, September 10, 1920, (C. D. Duncan).

18. *Psithyrus fernaldae* Franklin. Pequaming, Michigan, one male, August 8, 1903, (Morgan Hebard); Point Abbaye, Michigan, one male, August 4, 1903, (Morgan Hebard); Point Abbaye, Michigan, one male, July 31, 1903, (Morgan Hebard); Clingman

Dome, Blount County, Tennessee, August 4, altitude 6,000 feet, (H. A. Pilsbry); Corvallis, Oregon, one male; New Mexico, one male; Virginia, seven males; Massachusetts, one male.

19. *Psithyrus variabilis* var. *bicolor* Cockerell. Cloudcroft, New Mexico, one queen, June 16, 1902, (H. L. Viereck).

# STUDIES IN THE MANTIDAE AND PHASMIDAE OF PANAMA (ORTHOPTERA)

BY MORGAN HEBARD

The present paper represents the third of our studies in the Dermaptera and Orthoptera of Panama.[1] That section dealing with the Blattidae required more general discussion and revisionary treatment, due to the larger percentage of undescribed forms among the one hundred and six species now known[2] to occur in the region. The sources of the material for the present studies, acknowledgements, a brief discussion of the character of the country, and a map showing the localities where the material in question was taken, were therefore published in that paper.

In the first section of the present study the Mantidae are treated, the collection again showing a high percentage of the forms known from Panama. We are less fortunate, however, in the second section, which deals with the Phasmidae, as but sixteen species are represented, twenty-four other species having been reported from this region. This decided deficiency, in collections otherwise highly representative, is probably due in part to the close resemblance of many walking-sticks to their surroundings and their slow habit of movement, in part to the fact that many live in the twigs and vine tangles of the forest, where beating is most difficult and, as a rule, unproductive in those orders of insects which were particularly sought by the collectors of the greater portion of the material before us.

In this paper two hundred and eight Panamanian specimens are treated, two new genera and four new species being described.

[1] The other papers are:

"A Contribution to the Knowledge of the Dermaptera of Panama," Trans. Am. Ent. Soc., XLIII, pp. 301–334, (1917).

"The Blattidae of Panama," Mem. Am. Ent. Soc., no. 4, pp. 1–148, (1920).

[2] The small series, personally collected in 1920 and reported on during the following year (Ent. News, XXXII, pp. 161–169), increased the total by three species.

All material collected by Busck, Jennings and Schwarz belongs to the United States National Museum, all collected by Harrower and Hebard to the author's collection.

## MANTIDAE

Of the twenty-three species and one geographic race which we recognize as valid, now known from Panama, eighteen are represented in the one hundred and forty-nine specimens here recorded. Those not included are:[3] *Phyllomantis laurifolia* Saussure (Mantinae), *Tauromantis championi* (Saussure and Zehntner) (Mantinae), *Acontiothespis cordillerae* (Saussure) ("Acontistinae"), *Acontiothespis cordillerae vitrea* (Saussure and Zehntner) ("Acontistinae"), *Antemna rapax* Stål (Epaphroditinae) and *Vates pectinicornis* Stål (Vatinae).

We have followed the arrangement of Giglio-Tos, feeling that, though by no means final, it is a decided improvement over any previous classification. That author's concept of genera and species, however, is extremely unsatisfactory.

One new genus is described, but no new genera or species are represented in the material here recorded. The Mantidae is undoubtedly the smallest of the families of Orthoptera in Panama.

### Eremiaphilinae

**Mantoida maya** Saussure and Zehntner

1894. *Mantoida maya* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 125, pl. x, figs. 26 and 27. [♀; Temax, Yucatan, [Mexico].]

Rio Trinidad, Panama, III, 14, 1912, (A. Busck), 1♂.

The colorless stigma and immaculate limbs are given as characters to distinguish this species, known from Sinaloa, Yucatan and southern Florida, from the very closely allied South American *M. fulgidipennis* Westwood.

The measurements of this male, are: length of body, 15; length of pronotum, 2.1; length of tegmen, 14.5; greatest tegminal width, 3.2; length of caudal tibia, 5.7; length of caudal metatarsus, 2.4 mm.

[3] All but *Antemna rapax*, however, are at present represented in the Philadelphia Collections.

PSEUDOMIOPTERYGINAE

**Pseudomiopteryx infuscata** Saussure and Zehntner

1894. *Pseudomiopteryx infuscata* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 163, pl. IX, figs. 10, 11 and 12. [♂: Presidio and Cordova, Mexico; San Juan in Vera Paz, Las Mercedes, Volcan de Atitlan and Zapote, Guatemala; Chontales, Nicaragua; Bugaba, Caldera and Volcan de Chiriqui, Panama.]

Gold Hill, Canal Zone, Panama, XI, 14, 1913, (Hebard; from dead leaves on ground under bushes heavily overgrown with a dense tangle of vines), 1 juv. ♂.

As we have already stated,[4] *infuscata* may prove to be a synonym, or at best a geographic race, of *P. bogotensis* Saussure, described from Colombia. Additional series of both sexes are needed before more can be said.

**MUSONIA** Stål

As has been pointed out by Rehn,[5] the type of *Musonia* was first selected by that author as *surinama*, and as a result, Giglio-Tos' *Promusonia*, having *surinama* as genotype, is an absolute synonym of *Musonia*.

The species assigned by Giglio-Tos to what he incorrectly considered *Musonia* (*conspersa* (Saussure) and *major* Saussure and Zehntner) form a generic unit, differing from *Musonia* as properly restricted in the features given below. To this genus we give the name *Macromusonia*, designating the genotype as *Macromusonia* [*Musonia*] *major* (Saussure and Zehntner).[6] We believe that *major* is very probably a synonym of *conspersa*, but until the type of that species is examined, this will be difficult to decide.

A. Size small, very elongate, juxta-ocular portions of vertex only slightly convex and raised above median portion. Cephalic tibiae with ventro-internal margin armed with eight spines, of which the first to fourth and fifth to eighth form two series regularly increasing in size distad, the fifth being decidedly

[4] Trans. Am. Ent. Soc., XLV, p. 134, 1919.

[5] Proc. Acad. Nat. Sci. Phila., 1918, p. 167, footnote 21, (1918).

[6] We have selected *major* as genotype, as that species alone is fully described and figured.

shorter than the fourth; ventro-external margin armed with five spines, of which the first is well separated from the others, the first four rather small but increasing regularly in size distad, the fifth very large. **Musonia** Stål

AA. Size large, very elongate, juxta-ocular portions of vertex well raised and angulato-convex. Cephalic tibiae with ventro-internal margin armed with eight spines, regularly increasing in size distad, except that the fifth is very slightly shorter than the fourth; ventro-external margin armed with five spines, the interval between the first and second being only slightly greater than the succeeding intervals, the first four spines very small and increasing only slightly in size distad, the fifth very large. **Macromusonia** new genus

We note that *Macromusonia* is very closely related to *Paramusonia* Rehn, of which *cubensis* (Saussure) is the type. That genus differs only in having the vertex with dorsal margin convex between the eyes and therefore more elevated mesad than elsewhere (in *Musonia* and *Macromusonia* the dorsal margin of the vertex is transverse between the raised juxta-ocular portions) and with no juxta-ocular elevation, while the cephalic tibiae have the ventro-internal margins armed with eleven to twelve spines which increase regularly in size distad.[7]

**Musonia surinama** (Saussure)

1869. *Th[espis] surinama* Saussure, Mitth. Schweiz. Ent. Ges., III, p. 70. [♂, Surinam.]

1894. *Musonia femorata* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 166, pl. X, figs. 20 and 21. [♀; Chontales, Nicaragua.]

1911. *M[ionyx] fuscescens* Chopard, Ann. Soc. Ent. France, LXXX, p. 333. [♂, ♀; St. Laurent, La Forestiere and Nouveau-Chantier, French Guiana.]

After careful comparison of the numerous females of this species before us, with the original description of *femorata* Saussure and Zehntner, we find so exact agreement that we are obliged to place that name in the present synonymy. It is possible that the type specimen may have been incorrectly labelled, as the species is not represented in the large Costa Rican series before us, though we have a male labelled "Central America," collected by the Rev. T. Heyde.

[7] Comparison is made with material of *cubensis* in the Philadelphia Collections, from Cuba.

Through the kindness of its sponsor, a paratypic male of *fuscescens* Chopard, from St. Laurent du Maroni, French Guiana, is in the author's collection. Comparison satisfies us of the synonymy of this name as well. Specimens in the series here recorded are in every way similar, the general darkening being slight and representing merely a weak intensification of the normal coloration. In many species of the Mantidae, the difference between the extremes of recessive and intensive coloration are much greater.

Alhajuela, Panama, III, 8, to IV, 18, 1911 and 1912, (Busck; Zetek), 25♂, (7 intensive in coloration, 2 moderately so).

Paris Field, Cristobal, Canal Zone, Pan., VII, 7, 1920, (Hebard), 1♂.

Zone limit, five miles west of Empire, C. Z., Pan., XI, 14, 1913, (Hebard; among dead palm fronds, opening in jungle), 1♀, (moderately intensive in coloration).

Gold Hill, C. Z., Pan., IX, 14, 1913, (Hebard), 1♂; 1912, (Zetek), 1♂, [Hebard Cln.].

Paraiso, C. Z., Pan., I, 19 to IV, 24, 1911, (Busck), 3♂.

Corozal, C. Z., Pan., III, 12 and 25, 1911, (Busck), 4♂, 1♀, (1♂ moderately intensive in coloration).

Ancon, C. Z., Pan., (Jennings), 1♂; 1912, (Zetek), 1♂, [Hebard Cln.]; XI, 12 and 16, 1913, (Hebard; climbing about in short grass and low vines in semi-open areas), 2♂, 2♀.

La Chorrera, Pan., V, 17, 1912, (Busck), 1♀, (strongly intensive in coloration).

Though the size variation is considerable, the extremes here measured are connected up by a complete gradation in the large series at hand.

| ♂ | Length of body | Length of pronotum | Greatest width of pronotum | Length of tegmen | Width of tegmen |
|---|---|---|---|---|---|
| Alhajuela | 23.2 | 5.7 | 1.3 | 13.9 | 3.4 |
| Paraiso | 32.5 | 8 | 1.9 | 18.8 | 4.3 |

| ♀ | Length of body | Length of pronotum | Greatest width of pronotum | Length of supra-anal plate | Length of caudal metatarsus |
|---|---|---|---|---|---|
| Ancon | 30.3 | 8.5 | 2.3 | 1.9 | 3.4 |
| Near Empire | 35 | 9.3 | 2.4 | 2 | 3.5 |

The species is common and widely distributed in Panama. It frequents grasses and vine tangles in the open, but usually near the jungle, and when approached scrambles about hastily, much as does the North American *Oligonyx scudderi* Saussure. It is apparently very widely distributed over northern South America, having been recorded from Colombia, Venezuela, Dutch Guiana and French Guiana, while Chopard has recorded a specimen, referred to the synonymous *Mionyx fuscescens*, from the Gran Chaco, Argentina.

"THESPINAE"[8]

**Angela subhyalina** (Chopard)

1913. *Thespis subhyalina* Chopard, Ann. Soc. Ent. France, LXXXII, p. 754. [♂, ♀; Mapiri, Bolivia.]

Porto Bello, Panama, II, 25, 1911, 1 ♀, [U. S. N. M.]; III, 2, 1911, (Busck), 1 juv. ♀.

Gatun, Canal Zone, Pan., VIII, 6 to 22, 1916, (Harrower), 1 juv, ♂.

Rio Trinidad, Pan., III, 15 to 30, 1911, (Busck), 1 juv. ♂.

The adult female before us, except for being somewhat larger and having the membranous anal area of the tegmina dark, agrees in all respects with the female described by Chopard. The end of the abdomen was missing in that specimen. In the present female the merest traces of meso-distal tuberculation are suggested on the three tergites preceding the triangular supra-anal plate. This plate is as long as its basal width, with lateral margins showing exceedingly faint convexity to the almost acute apex.

So closely does this insect resemble *A. quinquemaculata* (Olivier) that we believe it may eventually be found to represent merely a depauperate, under-developed phase of that species. It differs only in the much weaker tuberculation of the distal abdominal tergites, the non-denticulate margins of the pronotal collar in the male, the much shorter organs of flight in the female and smaller size.

[8] This name falls, as *Angela* Serville must be used for the genus incorrectly recognized by Giglio-Tos as *Thespis*. The genus *Thespis* as correctly limited belongs to the eighth of Giglio-Tos' subfamilies and, as a result, no name is available for this, the ninth. We believe, however, that the present is an artificial group, not even representing a cohesive series of genera and, therefore, do not propose a name to take the place of the "Thespinae."

Length of body, 99.3; length of pronotum, 43.7; length of pronotal collar, 7.7; length of tegmen, 12; greatest tegminal width, 3.7; length of wing, 11.2; length of cercus, 4.8; width of cercus, 2 mm.

### Oligonicinae

**Thrinaconyx fumosus** Saussure and Zehntner

1894. *Thrinaconyx fumosus* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 179, pl. x, figs. 4 to 10. [♂; Volcan de Chiriqui, Panama.]

Porto Bello, Panama, VIII, 18 to 22, 1916, (Harrower), 1 ♀.

Alhajuela, Pan., IV, 8, 1911, (Busck), 1 juv. ♂; IV, 18, 1911, (Busck), 1 ♂.

Rio Trinidad, Pan., V, 4, 1911 and VI, 6, 1912, (Busck), 1 ♂, 1 ♀.

The female of this species was previously unknown. We note the following features for the specimen from Porto Bello.

Similar to male except as follows. Apterous. Size no larger, form slightly heavier except that the abdomen is decidedly heavier, this greatest meso-distad. Head slightly broader, vertex with dorsal margin less concave between the eyes, very weakly concave, with sulci weak; ocelli present but only half as large, the ventral ocellus with dorsal margin not acutely produced, as is the case in the male. Facial scutellum with height about two-fifths basal width as in male, convex dorsal margin not as distinct. Pronotum with surface and margins heavily dentate-tuberculate. Cephalic coxae with cephalic margin bearing nine distinct denticulations, the lateral margins with more numerous but not as heavy denticulations, caudal surface irregularly denticulate, all of these the bases of minute, microscopic hairs. Armament of cephalic femora and tibiae as in male but slightly heavier, the larger tibial spines all distinctly denticulato-serrulate under the lens. Supra-anal plate short, shield-shaped, length three-quarters of proximal width, medio-longitudinally carinate, lateral margins moderately convex-convergent to the rather sharply rounded apex; in male similar but with apex broadly rounded. Cerci very short, stout proximad, tapering decidedly to the terminal joint which is very slender and elongate; shorter and heavier proximad, with terminal joint more elongate than

in male. Caudal metatarsus nearly twice combined length of succeeding joints.

The cephalic tibiae are dark brown, distinctly tri-annulate with buffy, these colors being carried on to the distal portion of the femora, adjacent when the limbs are flexed, and contrasting strongly with the remaining internal portions of the femora and coxae, which are rich tawny. The other limbs are also decidedly annulate. This is also true for the additional female and immature male at hand. The adult males, however, have these features less strongly defined, the markings on the cephalic femora and tibiae being almost completely obscured.

*Measurements (in millimeters)*

| ♂ | Length of body | Length of pronotum | Greatest width of pronotum | Length of tegmen | Width of tegmen |
|---|---|---|---|---|---|
| Alhajuela | 12.7 | 3.4 | 1.3 | 10.8 | 3.7 |
| Rio Trinidad | 12.5 | 3.4 | 1.3 | 10.7 | 3.9 |
| ♀ | Length of body | Length of pronotum | Greatest width of pronotum | Length of caudal tibia | Length of caudal metatarsus |
| Porto Bello | 11.4 | 3.9 | 1.7 | 4.8 | 2.3 |
| Rio Trinidad | 12.1 | 4.1 | 1.7 | 5.2 | 2.6 |

**Pseudomusonia**[9] **lineativentris** (Stål)

1877. *M[usonia] lineativentris* Stål, Bih. till K. Svenska Vet.-Akad. Handl. v, no. 10, p. 66. [♂, Colombia.]

1894. *Mionyx saevus* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 167, pl. X, figs. 12 to 14. [♂; Bugaba and Volcan de Chiriqui, Panama.]

Though the only Colombian specimen before us is immature, the series at hand agrees so closely in all characters of real specific value that we feel fully justified in indicating the above synonymy. This series, however, shows the species to be subject to very decided size and color variation. As a result the very dark examples have a decidedly different facies from the paler individuals, while in the smallest specimens the tegmina are not only reduced in proportion but show no widening meso-distad.

Porto Bello, Panama, II, 19 to V, 3, 1911, (Busck), 1 ♂, 3 ♀; II, 21, 1911, (Schwarz), 1 ♂.

[9] Werner has proposed this generic name to take the place of *Mionyx* Saussure and Zehntner, preoccupied by *Mionyx* Cope, 1886, a genus of lizards Verh. K.-K. Zool.-Bot. Ges., Wien, LIX, p. 78, (1909).

Paris Field, Cristobal, Canal Zone, Pan., VII, 7 and VIII, 18, 1920, (Hebard; in low wet area of palms, vines and brush, 3 at night), 2 ♂, 2 ♀.

Gatun, C. Z., Pan., VIII, 6 to 22, 1916, (Harrower), 1 ♂; (Jennings), 1 ♂.

Paraiso, C. Z., Pan., I, 30, 1911, (Busck), 1 ♀.

Alhajuela, Pan., IV, 19, 1911, (Busck), 1 juv. ♀.

In the male sex the following cephalic limb armament is found. Femora with four discoidal spines, ventro-external margin with four moderately elongate spines, all genicular lobes with a very small conical spine, ventro-internal margin with the formula IıIIIIIıI. Cephalic tibiae with ventro-external margin showing three minute and one large distal spine, the first separated a greater distance from the others than they are from each other; ventro-internal margin with six or seven spines, the first two or three minute, the next large, the next half as large, the last two very large and elongate, the last above the ventral margin and adjacent to the side of the apical claw. In the female this armament is similar except that the tibial spines are microscopically serrulate and proportionately heavier, while the third spine from the end of the ventro-internal margin is scarcely a third as long as the preceding spine.

Compared with the male sex, females are seen to be decidedly larger and heavier and apterous. The ocelli are exceedingly minute, the pronotum with lateral margins very slightly more heavily denticulate, the supra-anal plate similarly mediolongitudinally carinate, linguliform, but slightly over twice as long as proximal width, instead of being less than twice as long as that dimension as found in the male.

*Measurements (in millimeters)*

| ♂ | Length of body | Length of pronotum | Greatest width of pronotum | Length of tegmen | Proximal width of tegmen | Greatest distal width of tegmen |
|---|---|---|---|---|---|---|
| Porto Bello | 28.5 | 7.8 | 1.8 | 14.2 | 3 | 2.8 |
| Porto Bello | 29.3 | 8.1 | 2 | 15.2 | 3.2 | 3 |
| Gatun.... | —— | 7.8 | 1.8 | 16.2 | 3.7 | 3.9 |
| Gatun.... | 34.8 | 8.9 | 1.8 | 19 | 3.7 | 4.4 |
| Paris Field | 31.7 | 8 | 1.8 | 18 | —— | 4.1 |
| Paris Field | 35.6 | 9.3 | 1.9 | 18.7 | 3.7 | 4.3 |

| ♀ | Length of body | Length of pronotum | Greatest width of pronotum | Length of tegmen | Length of caudal tibia | Length of caudal metatarsus |
|---|---|---|---|---|---|---|
| Porto Bello | 42 | 12.3 | 2.7 | — | 9.9 | 3.6 |
| Porto Bello | 42 | 12.9 | 2.8 | — | 9.8 | 3.7 |
| Porto Bello | 44 | 12.8 | 2.7 | — | 9.9 | 3.7 |
| Paris Field | 38.7 | 12 | 2.5 | — | 9.3 | 3.2 |
| Paris Field | 41.8 | 12.4 | 2.7 | — | 10.1 | 3.5 |
| Paraiso... | 38 | 11.9 | 2.4 | — | 9.3 | 3.2 |

The present series shows plainly the very decided variation which occurs in the species. In the smaller individuals the less ample tegmina do not widen distad. Such disproportion is unusual within a species, but in the present case we are satisfied that it represents mere individual variation.

The recessive type of coloration in males is as follows. Yellowish, irregularly tinged and flecked with dark brown on the body. Tegmina and wings transparent, evenly and strongly tinged with sepia, the transverse veinlets, but not the veins, distinctly paler, weakly tinged with brown. Ventral surface of abdomen light brown, showing a weak and obscure medio-longitudinal line of darker brown. Cephalic tibiae yellowish, showing very broadly three obscure annuli of dark brown. Median and caudal femora immaculate greenish yellow, the tibiae and tarsi immaculate yellowish. The individuals in the series before us show varyingly more intensive types to a condition which is very dark. The darkest male before us is dark brown in general coloration. Cephalic femora with two dorsal flecks of this color and cephalic tibiae obscurely tri-annulate with the same. Median and caudal limbs snuff brown, weakly suffused and flecked with darker brown, particularly at juncture of femora and tibiae. Tegmina and wings transparent, evenly and very strongly tinged with sepia, the veins sepia, the veinlets of the same color as the intervening areas, so that these organs are distinctly more uniform in coloration than in the recessive males. Ventral surface very dark brown, of abdomen heavily overlaid with blackish flecks and with a much obscured medio-longitudinal line of black.

The females also vary considerably in coloration. One was apparently pale green in life, another is light ochraceous-tawny, one is ochraceous-buff spotted with blackish, one is sayal brown

with a longitudinal line of dark brown on each side, running from back of the head to the apex of the abdomen, while two are warm sepia heavily suffused with bone brown.

### Liturgusinae

**Liturgusa cayennensis** Saussure

1869. *L[iturgusa] cayennensis* Saussure, Mittheil. Schweizer Ent. Ges., III, p. 62. [♀, Cayenne (= French Guiana).]

Porto Bello, Panama, III, 13, 1911, (Busck), 1 ootheca, 4 recently emerged juv.

Alhajuela, Pan., IV, 10, 1911, (Busck), 1 ootheca, 12 recently emerged juv.

Cabima, Pan., V, 17 to 29, 1911, (Busck), 1 ♂, 1 ♀, 2 juv., 1 ootheca.

Gatun, Canal Zone, Pan., 1913, (Zetek), 1 ♀, [Hebard Cln.].

Corozal, C. Z., Pan., XI, 17, 1913, (Hebard; on trunks of trees in clearing, much like *Gonatista* in actions, very rapid and alert), 1 ♀, 2 juv.

The streaked tegmina and much shorter caudal tarsi serve to separate this insect from the more slender but generally similar *L. annulipes* Serville.

The species of this genus live on the trunks of trees, when not in motion resting closely pressed to the bare surface. At such a time they blend astonishingly with their surroundings. Adults of the present species from Costa Rica, Panama and Trinidad agree closely in coloration of the tegmina, but a pair from French Guiana are of a more reddish brown, with the series of short gray or gray-green streaks on the principal veins missing. Such color variation would appear to be due to adaptation to immediate environment.

The ootheca of this insect is a small, smooth, gourd-shaped receptacle, its neck curved upward and affording the only exit for the young. These at the time of emergence are slightly less than 4 mm. in length.

### Photininae

**Macromantis ovalifolia** (Stoll)

1813. [*Mantis*] *ovalifolia* Stoll, Natuur. Afbeeld. Beschryv. Spooken, etc., Spooken, p. 58, pl. XIX, fig. 72, register p. 78. [♀, no locality given.]

Rio Trinidad, Panama, III, 18, and V, 9, 1911, (Busck), 2 small juv.

Compared with Colombian and Brazilian adults,[10] these immature individuals, only 24 and 26.5 mm. in length, agree closely in general form, the peculiar parallel sides of the pronotal supra-coxal expansion being distinctive. As in the adults, minute black flecks are found on the inner face of the cephalic trochanters and proximad on the same face of the cephalic femora, while the first discoidal spine is also marked with black.

### Choeradodinae

**Choeradodis rhombicollis** (Latreille)

1833. *Mantis rhombicollis* Latreille, in Humboldt and Bonpland, Obs. Zool., II, p. 103, pl. XXXIX, figs. 2 and 3. (No locality given.)

1880. *Choeradodis servillei* Wood-Mason, Ann. Mag. Nat. Hist., (5), VI, p. 161. [♀; Caché, Costa Rica: juv.; Chiriqui, Panama.]

1882. *Choeradodis brunneri* Wood-Mason, Journ. Asiatic Soc. Bengal, LI, pt. 2, p. 21. [♀; Bogotá, New Granada (= Colombia).]

A series of twenty-four specimens now before us, representing localities from Nicaragua to Ecuador, are clearly referable to but a single species. This species varies somewhat in size, pronotal outline, tegminal width, and decidedly in the extent of the black spot at the unguicular sulcus on the internal surfaces of the cephalic femora. Differences in these features led Wood-Mason to describe *servillei*[11] and *brunneri*. After comparison of the material at hand with the original descriptions, we do not hesitate to indicate the above synonymy. The individuals before us show many different gradations between the conditions which Wood-Mason believed to represent distinct species.[12]

Bocas del Toro, Panama, 1911, (Zetek), 2 ♂, [Hebard Collection].

Porto Bello, Pan., II, 18, to V, 4, 1911, (Busck), 2 ♂, 1 large juv. ♀, 1 small juv.

[10] Recorded and measured, Trans. Amer. Ent. Soc., XLV, p. 133, (1919).

[11] We have already stated that Saussure and Zehntner's separation of *servillei* and *rhombicollis* had no value. Trans. Amer. Ent. Soc., XLV, p. 130, (1919).

[12] Kirby, in his catalogue, places *rhombicollis* of Wood-Mason and subsequent authors (not of Latreille) under *peruviana* Serville. We do not believe he had sufficient evidence to warrant such action, but should it prove correct, *peruviana* also would fall as a synonym of *rhombicollis* (Latreille).

Cabima, Pan., V, 18 and 28, 1911, (Busck), 3 ♂.

In the adult males before us the pronotal proportions vary as follows: median length, 21.4 to 22.5; greatest width, 26.9 to 31.8 mm.

## Mantinae

### STAGMOMANTIS Saussure

1869. *Stagmomantis* Saussure, Mittheil. Schweizer Ent. Ges., III, p. 56. Genotype.—*Gryllus carolinus* Johansson.

1917. *Stauromantis* Giglio-Tos, Bull. Soc. Ent. Italiana, XLVIII, p. 54. Genotype.—*Stagmomantis theophila* Rehn.

1917. *Auromantis* Giglio-Tos, Bull. Soc. Ent. Italiana, XLVIII, p. 55. Genotype.—*Mantis limbata* Hahn.

1917. *Oromantis* Giglio-Tos, Bull. Soc. Ent. Italiana, XLVIII, p. 56. Genotype.—*Stagmomantis nahua* Saussure.

1917. *Uromantis* Giglio-Tos, Bull. Soc. Ent. Italiana, XLVIII, p. 56. Genotype.—*Stagmomantis heterogamia* Saussure and Zehntner.

The four synonyms indicated above have resulted from Giglio-Tos' designation as genera the phyla recognizable in the genus *Stagmomantis*. One alone of the genera so separated, *Isomantis* Giglio-Tos, appears to have validity, or to be at least worthy of subgeneric rank.

All of the others, as material now before us including all the genotypes satisfactorily demonstrates, are based on characters which, we are convinced, have at best no higher than group value within the genus.

**Stagmomantis tolteca** (Saussure)

1861. *Mantis* (*Stagmatoptera*) *tolteca* Saussure, Rev. et Mag. de Zool., (2), XIII, p. 127. [[♀], "Mexico calida."]

Porto Bello, Panama, III, 15, 1911, (Busck), 1 ♀, (medium size, green).

Gatun, Canal Zone, Pan., VIII, 6 to 22, 1916, (Harrower), 1 ♀, (large size, green).

Paraiso, C. Z., Pan., II, 1911, (Busck), 1 ♀, (medium small size, green).

Balboa, C. Z., Pan., 1921, (Zetek), 1 ♂, [Hebard Collection].

Panama, 2 ♂,[13] [U. S. N. M.]; (Dr. Newcomb), 2 ♀, [M. C. Z.]; (H. E. Wetherill), 1 ♂, [A. N. S. P.].

[13] Recorded by Rehn, Proc. U. S. Nat. Mus., XXVII, p. 564, (1904).

Specimens of this species are before us representing localities from Mexico to Colombia.[14]

**Stagmomantis theophila** Rehn

1904. *Stagmomantis theophila* Rehn, Proc. U. S. Nat. Mus., XXVII, p. 563. [♂; Turrialba, Costa Rica.]

1904. *Stagmatoptera insatiabilis* Rehn, Proc. U. S. Nat. Mus., XXVII, p. 572. [♀; Turrialba, Costa Rica.]

1916. *S[tagmomantis] denticulata* Chopard, Ann. Soc. Ent. France, LXXXV, p. 162. [♂; Chimbo, Ecuador.[15]]

1917. *S[tauromantis] festae* Giglio-Tos, Boll. Soc. Ent. Italiana, XLVIII, p. 55. [♂, ♀; Guayaquil and Vinces, Ecuador.]

Comparison of the male type of *Stagmomantis theophila* Rehn with the female type of *Stagmatoptera insatiabilis* Rehn confirms the synonymy established by Giglio-Tos.[16]

The coloration of *theophila* was not clearly described; this, the larger size and the widely separated locality apparently account for Chopard's *denticulata*. It would appear that Giglio-Tos had not seen the description of *denticulata* at the time he described *festae*. Distinct size variation occurs, the Ecuadorean male described by Giglio-Tos being somewhat smaller than those described by Chopard, which in turn are somewhat smaller than three Ecuadorean males before us.[17] These in turn also are somewhat smaller than the known Panamanian and Costa Rican males.

Porto Bello, Panama, IV, 20, 1912, (Busck), 1 ♂.
Rio Trinidad, Pan., III, 15 to VI, 6, 1912, (Busck), 5 ♂.
Cabima, Pan., V, 18, 1911, (Busck), 2 ♂.
Ancon, Canal Zone, Pan., (Jennings), 1 juv. ♂.

[14] We have discussed the close relationship to *S. carolina* (Johansson), Trans. Amer. Ent. Soc., XLV, p. 132, (1919). The present comparison shows further difference, in that the male of *toltcca* has the margins of the pronotal collar finely denticulate, this sometimes indicated, though even more weakly, on the cephalic portion of the pronotal shaft.

[15] Dr. Chopard has written us that this type is in the Bolivar Collection.

[16] Boll. Soc. Ent. Italiana, XLVIII, p. 55, (1917).

[17] In the collection of the Academy of Natural Sciences of Philadelphia; two from Paramba and one from Lita, Ecuador. In these the pronotum ranges from 17.2 to 17.7, the tegmina from 37.8 to 38 mm. in length; the pronotum from 3.5 to 3.6 in greatest width.

Not only are the denticulations of the cephalic coxae[18] and margins of the pronotum heavier than in any other species of the genus, but the collar of the pronotum also has its dorsal surface supplied with a few minute tuberculations on each side of the medio-longitudinal sulcus. This latter condition is, among the other species of the genus, found only in *S. nahua* (Saussure), there developed to a slightly greater degree.

The feeble longitudinal carinae of the median and caudal tibiae suggest the Vatid genus *Stagmatoptera*, as Chopard has remarked. In the female sex these carinae are more prominent and led Rehn to describe a specimen of that sex as *Stagmatoptera insatiabilis*. We do not believe that these carinae are sufficiently developed, however, to warrant assignment of the species to *Stagmatoptera*.

In the adult Panamanian males the pronotum ranges from 18.3 to 20.2, the tegmina from 36.8 to 37.4 mm., in length; the former from 3.7 to 3.8 in greatest width.

In the males the marginal field of the tegmina is transparent, hyaline tinged faintly with green toward the costal margin, with a broad opaque band of white margining the mediastine vein and disappearing opposite the stigma. The latter is subobsolete, longitudinal, weakly suffused with brown. The cephalic femora show three subobsolete transverse suffusions of brown in the majority of specimens, these are wholly obsolete in one, conspicuously intensified in another individual.

**Stagmomantis heterogamia** Saussure and Zehntner

1894. *Stagmomantis heterogamia* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 142, pl. VII, figs. 2 and 3. [♂, ♀; Bugaba, Panama.]

Porto Bello, Panama, IV, 17 to 24, 1912, (Busck), 1 ♂.

The distribution of this delicate and handsome little species is known to extend northward into Costa Rica.

[18] These are blunt triangular teeth, much heavier than in the other species, but in our opinion insufficient for generic separation, as are the other features given by Giglio-Tos in erecting the genus *Stauromantis* to include this species. Their number is variable, five to seven in our series, given as three by Chopard. The internal surfaces of these teeth are usually dark, sometimes almost black.

**Stagmomantis vicina** Saussure

1870. *St[agmomantis] vicina* Saussure, Mittheil. Schweizer Ent. Ges., III, p. 229. [♂; America meridional.]

1917. *U[romantis] centralis* Giglio-Tos, Bull. Soc. Ent. Italiana, XLVIII, p. 57. [♂; San Mateo, Costa Rica.]

1917. *U[romantis] similis* Giglio-Tos, Bull. Soc. Ent. Italiana, XLVIII, p. 57. [♂; San Mateo, Costa Rica.]

We believe that the present material should be referred to *vicina*, assuming that the specimen from Guatemala, subsequently discussed by Saussure, is the same as the type described from "America meridional." That author states that the tegmina are hyaline, while in well preserved material at hand the marginal field is opaque, buffy. In our series, however, are badly discolored specimens in which this is completely lost, the tegmina being plainly discolored but uniformly hyaline tinged with light brown. A Central American female, associated without hesitancy as the opposite sex of the males here recorded, agrees fully with a Guatemalan female described by Saussure, this strengthening our above conclusion.

It is certainly natural, under such circumstances, that Giglio-Tos considered his Costa Rican material distinct. It is, however, surprising that, at the present day, when so much more has been ascertained as to individual size variation, and the differences in color to be expected from that to which the terms recession and intensification have been applied, Giglio-Tos should have described, as two distinct species, material from the same locality representing so palpably such individual variation and nothing more.

La Chorrera, Panama, V, 11 and 27, 1912, (Busck), 4 ♂.

Corozal, Canal Zone, Pan., XI, 17, 1913, (Hebard; grassy opening in forest), 1 large juv. ♀.

Paraiso, C. Z., Pan., I, 26 and III, 25, 1911, (Schwarz; Busck), 1 ♂, 1 juv.

Ancon, C. Z., Pan., (Jennings), 1 ♂.

Balboa, C. Z., Pan., 1912, (Zetek), 1 ♂, [Hebard Cln.].

Taboga Island, Pan., II, 14 and 18, 1912, (Busck), 1 ♂, 2 juv.

Compared with *S. nahua* Saussure the present insect differs structurally most in the weaker supra-coxal expansion of the pronotum and weaker armament of the same, the males with surface of pronotal collar and its margins entirely unarmed. In

the adult males the pronotum ranges from 11 to 14.3, the tegmina from 23.7 to 26.6 mm. in length; the former from 2.4 to 2.8 mm. in greatest width.

An additional series of eight Central American specimens is before us, including a single female. The males show a brown and a green color phase, the green in the latter condition being confined to pronotum and limbs. All of the males which are in good condition, in addition to having the tegmina with marginal field opaque and strikingly buffy or whitish, have the narrow interval between the discoidal and median veins blackish brown proximad as far as the stigma. The internal surface of the cephalic femora has a blackish fleck on each side of the unguicular sulcus, these markings individually varying in size so that in one specimen the entire unguicular area is suffused with brown. In the female the wings are yellow in cephalic portion, black in caudal portion, as described by Saussure.

### Epaphroditinae

**Acanthops falcata** Stål

1877. *A*[*canthops*] *falcata* Stål, Bih. till K. Svenska Vet.-Akad. Handl., IV, no. 10, p. 90. [♂, ♀; New Granada (= Colombia).]

1896. *Acanthops erosula* Griffini (not of Stål, 1877), Bol. Mus. Zool. Anat. Comp. R. Univ. Torino, XI, no. 236, p. 6. [♀; Punta di Sabana, Darien, [Panama].]

1915. *A*[*canthops*] *griffinii* Giglio-Tos, Bull. Soc. Ent. Italiana, XLVI, p. 98. [♀; Punta di Sabana, Darien and Panama.]

The material here recorded agrees fully with Giglio-Tos' very short description and Griffini's much more satisfactory diagnosis, the references to which are noted above. No difference, however, appears to exist to warrant separation from Stål's *falcata*,[19] a species which Giglio-Tos apparently did not consider at the time he recognized the fact that Panamanian material was distinct from *erosula* (= *A. tuberculata* Saussure[20]).

Paris Field, Cristobal, Canal Zone, Panama, VIII, 18, 1920, (Hebard; in low wet area, palms, vines and brush), 1 very small juv.

[19] Stål stated, apparently inadvertently, that the thickening of the median and caudal tibiae in males of this and another species was beyond the middle, while in reality these members are thickened in their proximal half.

[20] See discussion by Chopard, Ann. Soc. Ent. France, LXXXV, p. 181, (1916).

Gatun, C. Z., Pan., (Harrower), 2 ♂, 2 ♀.

Paraiso, C. Z., Pan., I, 17, 1911, (Schwarz), 1 juv.

Calidoma Road, Pan., IV, 12, 1911, (Jennings), 1 small juv.

Ancon, C. Z., Pan., V, 8, 1911, (Dr. Greenwood), 1 ♂, [U. S. N. M.].

Unrecorded material of this species is also before us from Trinidad and British Guiana, showing that *falcata*, like several other species of the genus, has a very wide distribution in tropical America.

## Vatinae

**Stagmatoptera septentrionalis** Saussure and Zehntner

1894. *Stagmatoptera septentrionalis* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 186, pl. VIII, fig. 2. [♀; Bugaba, Panama.]

Porto Bello, Panama, V, 2, 1911, (Busck), 1 ♂, 2 oothecae.

Pinogana, Darien, Pan., XII, 1915, (Munoz), 2 ♂,[Hebard Cln.].

Gatun, Canal Zone, Pan., VII, 28 to VIII, 22, 1916, (Harrower), 3 ♂, 2 juv. ♀.

Panama, 3 ♂.

We have recently placed Saussure and Zehntner's variety *minor* as an absolute synonym of this species.[21]

The ootheca appears to be of the same general type as that deposited by species of the genus *Stagmomantis*, though much larger than any we have seen referable to that genus.

**Phyllovates chlorophaea** (Blanchard)

1835. *Mantis chlorophaea* Blanchard, Mag. Zool., V, Ins. pl. 135. [♀; Watertown, New York (in error).]

1894. *Thcoclytes chlorophaea* variety *cornuta* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 191. (Locality for variety not given separately.)

1894. *Thcoclytes maya* Saussure and Zehntner, Ibid., p. 192. [♂, ♀; Tabasco and Temax, Yucatan, Mexico.]

Bugaba, Panama, (W. Schaus), 1 ♂, [U. S. N. M.].

Bocas del Toro, Pan., 1911, (Zetek), 1 ♂, [Hebard Cln.].

Corozal, Canal Zone, Pan., 1912, (Zetek), 1 ♂, [Hebard Cln.].

Panama, VIII, 21, 1908, (P. B. Preston), 1 juv. ♀, [U. S. N. M.].

Careful comparison of a series of eighteen specimens before us, representing localities from Mexico to Colombia, offers convincing evidence of the synonymy indicated above, *cornuta*

[21] Trans. Am. Ent. Soc., XLVII, p. 160, (1921).

representing individuals of the optimum development, *maya* the greatest depauperation which is known to occur in the species. Giglio-Tos has given additional characters to separate these,[22] but the series before us shows all to be attributable to individual variation, rather than constituting diagnostic features.

Under this variable species, the names *Theoclytes azteca* Saussure and *mexicana* Saussure have already been placed, and it is probable that *Pseudovates brevicornis* Stål, described from Colombia, will also prove to be a synonym.

The measurements of selected individuals of the series before us are as follows:

| ♂ | Length of body | Length of frontal process | Length of pronotum | Length of pronotal shaft | Length of tegmen | Length of cephalic coxa |
|---|---|---|---|---|---|---|
| Venvidio, Sinaloa, Mexico | 58 | 3 | 23.3 | 19.5 | 36.3 | 11.1 |
| Venvidio, Sinaloa, Mexico | 65.5 | 3.3 | 29.7 | 25.3 | 44.8 | 14 |
| Teocelo, Vera Cruz, Mexico | 68 | 2.8 | 28 | 23.7 | 50 | 12.7 |
| Costa Rica | 56.5 | 2.5 | 25 | 21.2 | 46.5 | 11.8 |
| Costa Rica | 65 | 2.8 | 27.7 | 23.3 | 49.3 | 12.2 |
| Costa Rica | 67.5 | 3.3 | 29.3 | 25 | 45.2 | 12.7 |
| Bugaba, Panama | 65.5 | 2.5 | 27.2 | 23.1 | 44 | 12.2 |
| Corozal, Panama | 69.5 | 3.1 | 30.7 | 26 | 48.7 | 13.2 |
| Honda, Colombia | 67 | 3 | 27 | 23 | 48.8 | 12.2 |
| ♀ | | | | | | |
| San José, Costa Rica | 74 | 3.3 | 35.5 | 29.7 | 43.3 | 16.8 |
| Pozo Azul, Costa Rica | 78 | 3.7 | 35.7 | 30 | 44 | 16.2 |
| Siquirres, Costa Rica | 83 | 5 | 39.8 | 33.8 | 45.3 | 16.9 |
| Fusugasuga, Colombia | 72.8 | 3.2 | 34 | 28.7 | 42.8 | 15.8 |

The frontal process is more flattened in the females than in the opposite sex, with its apices usually slightly less sharply rounded, while in the males the length of the cephalic coxae averages greater in proportion to that of the pronotal shaft.

**Phyllovates stolli** (Saussure and Zehntner)

1894. *Theoclytes stolli* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 192. [♀; Guiana; Brazil.]

Gatun, Canal Zone, Panama, VII, 25 to 31, 1916, (Harrower), 1 ♂.

The male of this handsome species is very rare in collections. This sex has been described and recorded only by Saussure, as *Theoclytes cingulata* (Drury).[23]

[22] Boll. Mus. Zool. Anat. Comp. R. Univ. Torino, XXIX, no. 684, p. 39, (1914).

[23] A very distinct West Indian species, belonging to the genus *Vates*.

In the male the coloration of tegmina and wings is much like that of the same sex of *P. chlorophaea* (Blanchard), except that the opaque distal area in the discoidal field of the tegmina is even less extensive, occupying only an area of the apical portion toward the discoidal vein no wider than the marginal field.

Length of body, 61; length of frontal process, .8; length of pronotum, 25.6; length of pronotal shaft, 21.3; length of tegmen, 41; width of tegminal marginal field, 3.8; length of cephalic coxa, 11 mm.

## PHASMIDAE

Though the fifty-nine specimens here recorded represent only a small portion of the walking-sticks known from Panama, it is of interest to note that four of the sixteen species treated are new.

The following Phasmidae, already known from Panama, are not represented in the collections before us from that region. *Stratocles cinctipes* Stål (103),[24] *Tenerella tenerrima* Redtenbacher (109), *Agrostia amoena* Redtenbacher (110), *Brizoides nigricornis* Redtenbacher (112), *Brizoides gramina* Redtenbacher (113), *Brizoides lactipennis* Redtenbacher (113), *Chlorophasma hyalina* Redtenbacher (114), *Perliodes griseseens* Redtenbacher (137), *Perliodes nigro-granulosus* Redtenbacher (138), *Metriotes diocles* Westwood (140), *Damasippus fuscipes* Redtenbacher (147), *Damasippus westwoodi* Stål (148), *Damasippus striatus* Redtenbacher (149). *Oncotophasma armata* (Brunner) (317), *Dyme discors* Brunner (324), *Dyme modesta* Brunner (324), *Dyme chiriquensis* Brunner (325), *Calynda bicuspis* Stål (329), *Phantasis lobata* Redtenbacher (408), *Bostra dorsuaria* Stål (408), *Bostra lobata* Redtenbacher (408), *Bostra podagrica* Stål (409), *Bacteria nodulosa* Redtenbacher (416).

Forty species of Phasmidae are now recorded from Panama. We feel, however, that it is very probable additional synonymy will be found in the genera *Dyme, Calynda* and *Bostra.*

[24] The numbers in parentheses after the names indicate the page number in the "Insektenfamilie der Phasmiden" on which the species is treated.

ANISOMORPHINAE

**Paranisomorpha insignis** Redtenbacher

1908. *Paranisomorpha insignis* Redtenbacher, Insektenfamilie der Phasmiden, p. 90. [♂, ♀; Costa Rica.]

Boquete, Panama, II, 1919, (Zetek), 1 ♀, 1 juv. ♀, [Hebard Cln.].

The adult female of this dull black, apterous walking-stick is in all but body length smaller than the female originally described. Length of body, 41.8; length of pronotum, 4.3; length of mesonotum, 6.4; length of metanotum including median segment, 5.3; length of cephalic femur, 11.3; length of median femur, 10.5; length of caudal femur, 14.7 mm.

The thickening of the antennal segments distad is not conspicuous in the specimens before us.

PHASMINAE

**Stratocles multilineatus** Rehn

1904. *Stratocles multilineatus* Rehn, Proc. Acad. Nat. Sci. Phila., 1904, p. 91. [♂; San Carlos, Costa Rica.]

1906. *Str[atocles] forcipatus* Redtenbacher, (not of Bolivar, 1896), Insektenfamilie der Phasmiden, p. 105. [♂, ♀; Chiriqui and Bugaba, Panama.]

It is plain that Redtenbacher made the misidentification noted above. The insect described as *multilineatus* by that author from the upper Amazon may represent a closely related species.

Gatun, Canal Zone, Panama, VII, 17 to VIII, 22, 1919, (Harrower), 8 ♂, 6 ♀.

Panama, VII, 4, (Wirt Robinson), 1 ♂.

The male cerci in *multilineatus* are directed ventrad and weakly curved, then cephalad and strongly curved, more slender, rounded and weakly tapering distad to their rounded apices, armed with an irregular, flattened finger, the apex of which is enlarged, flattened and armed with very minute, scattered denticulations.[25] This projection was overlooked by the original describer, probably because, directed cephalad and slightly dorsad, it can not be seen from above or the side.

The pale portions of head, pronotum, mesonotum, tegmina, anterior field of wings and limbs are usually richly oriental green. Rarely all of these markings, except those of the tegmina and wings, are naples yellow.

[25] Bolivar describes the male cercus for *forcipatus* as "elongati, apicem versus intus compresso-subampliatus, ante medium biramosi, ramo antico brevi, spiniformi, postico magis elongato, subcylindrico."

**Agrostia viridipes** (Rehn)

1905. *Olcyphides viridipes* Rehn, Proc. Acad. Nat. Sci. Phila., 1905, p. 798. [♂ (nec ♀); Caché, Costa Rica.]

Cabima, Panama, V, 28, 1911, (Busck), 1 ♂.

Compared with a Colombian male of the gorgeously colored *Citrina venilia* (Westwood) shows, in addition to the features given by Redtenbacher, the following characters, which, combined, warrant the generic separation made by that author. In *viridipes* the head is decidedly longer, the eyes and ocelli smaller and less prominent, the pronotum shorter, the tegmina much longer, the cephalic femora showing distinctly greater thickening and the tarsi, though elongate, decidedly shorter.

The present species is distinctively colored, the pale green of the median and caudal limbs and of the longitudinal tegminal and wing band contrasting strongly with the light and dark browns of the other portions.

The specimen here recorded agrees fully with the type except in being somewhat smaller. Length of body, 47; length of head, 3.7; length of pronotum, 2.1; length of mesonotum, 5.8; length of tegmen, 5.8; length of wing, 30.5; length of caudal femur, 12.8; length of caudal tarsus, 5.8; length of caudal metatarsus, 3.2 mm.

**Brizoides annulicornis** new species (Plate XIV, figures 1 and 2.)

This beautiful light green walking-stick is nearest *B. graminea* Redtenbacher, described from Bugaba, Panama. It differs in the strikingly annulate antennae, granulose cephalic half of mesonotum, with a few of these granules laterad black but median sulcus immaculate, faint markings of anterior field of wings and limb annuli, shorter tegmina and longer limbs.

The carinae of the limbs are used largely by Redtenbacher to separate this and the related genera. These features are often more subtle than would be supposed. In the insect here under consideration we would describe the cephalic femora as having the dorsal carinae distinct, the dorso-internal slightly the stronger with the median carina of the ventral surface certainly present but not strongly developed. This would appear to represent a condition intermediate between *Brizoides* and *Chlorophasma* as defined by Redtenbacher. For the present we can go no further than to assign *annulicornis* to *Brizoides*, awaiting

further material to determine the validity of the genus *Chlorophasma*.

*Type*.—♀; Porto Bello, Panama. March 2, 1911. (A. Busck.) [United States National Museum.]

Size large for the genus, form slender. Ocelli small but distinct. Eyes moderately but not strongly projecting. Head and pronotum smooth, the latter with transverse sulcus decided and longitudinal sulcus weak. Mesonotum smooth in caudal portion, with a well defined transverse sulcus; cephalic portion granulose and with a few blunt lateral tubercles, longitudinal sulcus shallow but distinct. Tegmina large for the genus (but decidedly surpassed in size by those of *graminea*), ovate but showing strong distal obliquity to the rounded apex at the sutural margin, flattened but showing blunt tuberculation at the shoulders. Wings fully developed, reaching to near base of eighth tergite. Abdomen with tergites (except supra-anal plate) not carinate. Ultimate tergite truncate, weakly bilobate distad, with a minute, rounded supra-anal plate projecting beyond, which is shorter than wide and is mediolongitudinally carinate. Mesosternum alone finely granulose. Operculum elongate, extending slightly beyond median portion of ultimate tergite, smooth and not carinate, narrowing distad to the sharply rounded apex which forms an angle distinctly less than ninety degrees. Femora all bicarinulate dorsad and ventrad, the cephalic decidedly incurved at base; median carina of ventral surface weak but distinct on cephalic femora, a trace suggested distad on the median femora, absent on the caudal femora. Tibiae all pentagonal.

General coloration apple green, underparts chamois. Antennae with first two joints immaculate, succeeding joints with a heavy short distal annulus of blackish brown, these annuli becoming much longer and more widely spaced distad where the joints become compound, a number of the short sections of the compound joints there form these annuli; proximal annuli incomplete as they do not wholly encircle the antennae. Head with a very slender postocular streak of blackish brown, pronotum immaculate. Mesonotum with (three or four) lateral tubercles black and with a very slender marginal streak of blackish brown below the slender carinae, which are approximate to the lateral margins. Tegmina and anterior field of wings, with scattered angular patches which are slightly darker than the general coloration, apparently bice green, but under the lens seen to be a shade darker than the other portions with a number of microscopic irregular flecks of purplish black. Radiate field of wings transparent milky white, like ground glass. Limbs buffy tinged with green, showing very obscurely traces of a number of light brownish annuli. Femora, tibiae and tarsal joints all minutely flecked with blackish brown at their apices.

The type measurements are given first. Females. Length of body, 73 and 74; length of pronotum, 3.7 and 3.8; length of mesonotum, 7.8 and 8.7; length of tegmen, 6.8 and 6.8; length of wing, 49.5 and 49.8; length of cephalic femur, 16.9 and 16; length of caudal femur, 16.3 and 15.4; length of caudal tarsal joints, 7.4 and 7.2; length of caudal metatarsus, 3 and 3.2 mm.

A paratypic female, bearing the same data as the type, is also before us.

**Pseudophasma**[26] **menius** (Westwood)

1859. *Phasma menius* Westwood, Cat. Orth. Ins. British Mus., I, Phasmidae, p. 118, pl. XVII, fig. 2. [♂, Colombia.]

This species has been previously correctly reported from the Rio Cianati, Darien, Panama, by Griffini, and from Carrillo, Costa Rica, by Rehn. It is assuredly the insect which Redtenbacher has recorded from Costa Rica and Chiriqui, Colon, Panama, and Darien, Panama, as *Phasma perezii* Bolivar.[27]

Porto Bello, Panama, II, 27 to V, 4, 1911, (Busck; Jennings), 4 ♂, 3 ♀.

Gatun, Canal Zone, Pan., VII, 17 to VIII, 22, 1916, (Harrower), 7 ♂, 1 ♀.

Culebra, C. Z., Pan., I, 8, 1911, (Dr. Pittier), 1 ♀, [U.S.N.M.].

This plainly and somberly colored species is apparently the most abundant flying walking-stick in both Costa Rica and Panama.

**Isagoras dentipes** Redtenbacher

1906. *Isagoras dentipes* Redtenbacher, Insektenfamilie der Phasmiden, p. 134. [♂; Bugaba and Chiriqui, Panama.]

Bugaba, Panama, (W. Schaus), 1 ♂, 1 ♀, [U. S. N. M.].

In these specimens the metasternum is pale, buffy caudad, but not sulphur yellow.

The undescribed female is decidedly larger than the male with the tuberculation of the body and lamellation of the limbs intensified, while on the latter are developed larger and more numerous lobes (or blunt denticulations). In this specimen the cephalic femora are much more strongly compressed. The caudal femora have the dorso-external margin supplied with (four or five) small lobes; the dorso-internal margin with six much larger lobes; the ventro-internal margin with a long, low, horizontal lobe proximad and a similar, but vertical, lobe distad,

[26] The necessity of following Kirby in the use of this name for *Phasma* of authors (not of Lichtenstein as restricted) has been fully explained by Rehn, Proc. Acad. Nat. Sci. Phila., 1904, p. 95, footnote 43, (1904).

[27] As Redtenbacher considered his material from Coca, Ecuador (the type locality of *perezii*) the same as that from Panama, it would appear very possible that *perezii* may be a synonym of *menius*.

and the ventro-external margin with a similar, but lower, distal lobe. The caudal tibiae also have (two or three) small dorsal lobes, these conspicuous only on the sinistral member.

The female before us is more lichenose in appearance than the male, the antennae grayish with suffusions of brown. In both sexes the ocelli are small but distinct, while on each side of the median ocellus, between it and the antennal socket, is a long tubercle, like a minute horn. As in other bark-like or lichen-like forms, the coloration is probably subject to very decided individual variation. The same is true of the lobes of the limbs, in such species as the present.

Length of body, ♂ (estimated) 53; ♀ 75.7; length of pronotum, ♂ 2.8, ♀ 3.9; length of mesonotum, ♂ 7.7, ♀ 10; length of tegmen, ♂ 5.3, ♀ 8.5; length of wing, ♂ 31.8, ♀ 49.2; length of cephalic femur, ♂ 11.1 ♀ 13.1; width of cephalic femur, ♂ .9, ♀ 2; length of caudal femur, ♂ 8.8, ♀ 10.8; length of caudal tibia, ♂ 7.5, ♀ 8.7; length of caudal tarsal joints, ♂ 5.4, ♀ 5.9; length of caudal metatarsus, ♂ 2.3, ♀ 2.3 mm.

**Isagoras vignieri** (Redtenbacher)

1906. *Xerosoma vignieri* Redtenbacher, Insektenfamilie der Phasmiden, p. 144. [♂; Paya, Darien, Panama.]

The species does not agree with the genotype of *Xerosoma*, the Brazilian *canaliculatum* of Serville, but shows no feature by which it can be separated from *Isagoras* Stål, as defined by Redtenbacher.[28] We, therefore, make the generic reassignment noted above.

Porto Bello, Panama, II, 6, 1911, (Schwarz), 1 ♂; III, 2 and 18, 1911, (Busck), 2 juv. ♂.

The adult specimen, for a lichenose form, agrees very closely with the originally described male. It differs mainly in having the mesonotal tubercles no darker than the other portions, the costal margin of the tegmina and the anterior portions of the wings without a pale marking,[29] while the minute lobes of the median and caudal limbs are reduced to one and two on the

[28] Redtenbacher has very possibly included several generic units under *Isagoras*, but we do not have material of a sufficient number of species to determine this definitely.

[29] The tegmina having a large, transverse, pale area at the shoulders across the dorsal surface.

dorsal surface of the caudal tibiae. The ocelli are very small and inconspicuous.

Length of body, 65; length of pronotum, 3.2; length of mesonotum, 10; length of tegmen, 9.1; length of wing, 43.3; length of cephalic femur, 14.8; width of cephalic femur, 1.8; length of caudal femur, 12.7; length of caudal tibia, 12.7; length of caudal tarsal joints, 6.3; length of caudal metatarsus, 2.7 mm.

**Metriotes iphicles** Redtenbacher

1906. *M[etriotes] iphicles* Redtenbacher, Insektenfamilie der Phasmiden, p. 140. [♂, ♀: San Pedro Sula, Honduras; Bugaba, Panama.]

Rio Trinidad, Panama, VI, 6, 1912, (Busck), 1 large juv. ♀.

**Prisopus berosus** Westwood

1859. *Prisopus berosus* Westwood, Cat. Orth. Ins. British Mus., I, Phasmidae, p. 168, pl. xx, fig. 7. [♂ ♀; Panama.[30]]

Panama, (Zetek), 1 ♀, [Hebard Cln.].

This species is also represented in the collections before us from Costa Rica. The coloration of the present specimen is exactly as described, with great clarity, by Westwood.

Length of body, 59; length of pronotum, 5.2; width of pronotum, 7.8; length of mesonotum, 6; length of tegmen, 34.4; length of wing, 45.6; length of cephalic femur, 10.8; greatest width of cephalic femur, 5.9; length of caudal femur, 13.5; greatest width of caudal femur, 6 mm.

**Prisopus ariadne** new species (Plate XIV, figures 3 to 8)

This interesting species agrees only with *P. cephus* Westwood in having the radiate field of the wings unicolorous. The numerous glossy yellowish tubercles, scattered over the proximal portions of the tegmina, afford a distinctive character. Compared with the described male of *cephus*, this sex differs further in having the head tuberculate but not spinose, the tegmina with the tuberculations noted above, and with a lamellate, acute-angulate production at the shoulders, and the five distal tergites lobate laterad, this strongest on the seventh.

The female differs in being larger and heavier, with projection at tegminal shoulders reduced to a low rounded lamella, and lateral lamellation of tergites much stronger.

[30] And "Litt. occid. Americae septentrionalis." The figured male from Panama is here designated the single type.

*Type.*— ♀ ; Carrillo, Costa Rica. [Hebard Collection, Type no. 869.]

Size rather small and form more slender than is usual in this genus of very broad species. Head flattened, the occiput with small scattered tubercles and two postocular rows of the same on each side (these not large and not forming small denticulations as in this sex of *P. berosus* Westwood). Pronotum polished but rugulose, slightly wider than long. Mesonotum with surface similar, shorter than pronotum, transverse but decidedly less so than in *berosus*. Tegmina large, extending as far caudad as caudal margin of fifth tergite, veins proximad forming a number of small smooth tubercles, shoulder with a low rounded lamella, apices broadly rounded. Wings fully developed, extending to apex of abdomen. Abdomen with dorsal surface tuberculate meso-laterad and distad; fourth tergite minutely and roundly lamellate produced latero-caudad, fifth, sixth and seventh tergites increasingly and much more decidedly so, eighth and ninth tergites with lateral portions lamellate and rounded produced but decreasingly so. Cerci straight, flattened cylindrical. Ventral surface strongly concave. Femora very strongly lamellate and hairy; their external surfaces weakly tuberculate; their ventro-external margins with very large waves, well separated and blunt but shaped like the teeth of a saw, these decided on the cephalic femora, subobsolete (or weak in paratype) on the median femora and very decided on the caudal femora, there six in number. Dorso-external margins of cephalic femora strongly lamellate and convex in distal half, of median femora straight and subdenticulate (or with three small denticulations), and of caudal femora straight with three blunt denticulations. Tibiae lamellate and hairy; external surfaces similarly tuberculate; the margins of the cephalic and median straight (or of median with two low undulations of the dorsal margin), of the caudal tibiae with ventral margin showing four large lamellate and rounded waves. Subgenital plate produced caudad in median section, the lateral margins in this portion very weakly convergent to the transverse and very feebly convex distal margin.

*Allotype.*—♂; Alhajuela, Panama. April 17, 1911. (A. Busck.) [United States National Museum.]

Very similar to female but smaller and less robust. Tegmina similar except that they are produced in a sharp acute-angulate lamellation at the shoulders and extend to the caudal margin of the fourth tergite. Lateral lamellation of distal tergites similar but much weaker. Limbs similar.[31] Subgenital plate with lateral margin converging, then rounding into the obtuse-angulate emarginate distal margin, so that the plate appears almost bilobate.

General coloration brown, limbs weakly mottled. Tegmina and exposed portion of wings, when at rest, lichenose, blotched with gray-green, grayish white and brown, the proximal tubercles on the tegmina honey yellow, in the

[31] In such lichenose or bark-like insects, variation is probably greater than is usual in the Phasmidae. In the present male the sinistral caudal tibiae has its ventro-external margin only undulate, though the corresponding margin of the dextral limb is as described for the type.

male faintly tinged with green. Remaining portion of anterior field of wings transparent, heavily suffused with mummy brown; radiate field transparent, evenly and strongly tinged with mummy brown. Ventral surface smooth and shining, buffy with median portions of sterna suffused with blackish brown and each sternite, to subgenital plate, with a medio-longitudinal oval suffusion of blackish brown (this latter marking apparently an important specific diagnostic character).

For the female sex, the measurements of the type are given first. Length of body, ♂ 39, ♀ 49.7 and 56; length of pronotum, ♂ 3.3, ♀ 4.4 and 4.4; total width of pronotum, ♂ 4, ♀ 5.6 and 5.7; length of tegmen, ♂ 20, ♀ 28.3 and 31.4; greatest tegminal width, ♂ 4.7, ♀ 7.5 and 7.9; length of wing, ♂ 29.2, ♀ 36.8 and 42.3; length of cephalic femur, ♂ 8.1, ♀ 9 and 9.1; greatest width of cephalic femur, ♂ 2.7, ♀ 3.7 and 4; length of caudal femur, ♂ 9.1, ♀ 10.3 and 10.2; greatest width of caudal femur (between apices of projections), ♂ 3.1, ♀ 4.5 and 4.7 mm.

In addition to the type and allotype, a paratypic female, belonging to the United States National Museum, is before us, taken at Paraiso, Canal Zone, Panama, on April 4, 1912, by A. Busck.

## Heteroneminae

### **PSEUDOCEROYS** new genus

This genus is erected to include a new species, *harroweri*, here described, and *Ceroys bigibbus* Rehn, from Nicaragua and Costa Rica.

Close general resemblance is shown to the heavy type developed in the Pyghirynchine genera *Pyghirynchus* and *Ceroys*, the present genus being, however, a member of the Heteroneminae (Bacunculinae of Brunner), as the tibiae all lack a triangular impressed area disto-ventrad.

We place *Pseudoceroys* after *Parapyghirynchus* in linear arrangement. These and the related genera, as defined and arranged by Brunner, in the Insektenfamilie der Phasmiden, are so illogical and unsatisfactory that his treatment must be largely disregarded.[32]

Genotype.—*Pseudoceroys harroweri* new species.

The following characters serve to separate this genus, known as yet only from the female sex. Tibiae anareolate. Median segment transverse. Form moderately robust. Abdomen with latero-caudal angles of tergites not specialized, sixth tergite

[32] See Hebard, Trans. Am. Ent. Soc., XLV, pp. 162 and 172, (1919), for the order of the first genera of the Heteroneminae.

specialized. Antennae comparatively short, with first joint depressed, unarmed. Ocelli absent. Occiput with a pair of auriform lobes. Pronotum with a pair of median, longitudinal carinae. Mesonotum, metanotum and median segment with a heavy, medio-longitudinal carina, the abdominal tergites with this less decided. Tegmina and wings absent. Operculum lanceolate, very elongate, concealing ovipositor valves and cerci, extending beyond apex of distal tergite. Limbs short and rather heavy; femora and tibiae with margins supplied with numerous lobes or lobules; cephalic femora strongly bowed.

**Pseudoceroys harroweri** new species (Plate XV, figures 1 and 2)

This insect, compared with *P. bigibbus* (Rehn), both known only from the female sex, differs in its very much smaller size, more robust build, decidedly smaller lobes of the head and limbs, absence of lobes on mesonotum, metanotum and sixth tergite, and distinctive operculum.

*Type.*—♀; Porto Bello, Panama. August 18 to 22, 1916. (D. E. Harrower.) [Hebard Collection, Type no. 864.]

The following features are noted in addition to those given above and in the generic description. Surface dull, weakly rugose and subtuberculate. Head with a pair of small, elongate tubercles, like minute horns, between the eyes; auriform lobes of occiput irregular and bluntly rounded, wider than high, caudad of which are a pair of more approximate, blunt spiniform processes. Pronotum very rough, paired median carinae moderately divergent caudad and each raised in a large, blunt, conical projection at caudal margin of pronotum; a carina also indicated laterad on the roughened sides. Mesonotum rough, with medio-longitudinal carina heavy, armed with three, heavy, blunt, conical projections. Metanotum and median segment similar but lacking the projections. Abdominal tergites to sixth rough and unspecialized, sixth flattened and irregularly weakly concave on each side with a dark velvety patch proximad. Sixth, seventh and eighth tergites with medio-longitudinal carina horizontally minutely bilobate caudad on each side. Ninth tergite strongly declivent produced in two small rounded projections at the base of the small supra-anal plate, the latter with margins evenly and weakly convex-convergent to the bluntly rounded apex. Ventral surface rough, the pleura tuberculate. Operculum with surface not as rough, longitudinally tricarinate proximad but without lateral carinae distad, in that portion with lateral margins very feebly convex-convergent to the rather sharply rounded apex. Cephalic femora with dorso-internal and ventro-external margins (the latter only distad) supplied with a few very small, stout lobes; other femora with all margins and all tibiae with dorsal margins supplied with a number of slightly larger lobes, except the ventral margins of the caudal femora, which have these only distad.

General coloration dark brown, the velvety areas proximad on each side of the sixth tergite blackish brown.

Length of body, 53; length of auriform lobe of head, 1.9; length of pronotum, 4; length of mesonotum, 13; width of mesonotum, 5; length of metanotum (including median segment), 6; length of cephalic femur, 10.8; length of cephalic tibia, 10.3; length of caudal femur, 12.7; length of caudal tibia, 12; length of operculum, 10.7 mm.

The type of this somber, twig-like phasmid is unique.

**Libethra panamae** new species (Plate XIV, figure 9; XV, figures 3 and 4)

This insect is nearest *L. venezuelica* Brunner, differing in the female in the cephalic femora being dilated dorsad and in the specialization of the second and sixth tergites; in the male in the apex of the abdomen being apparently[33] not as strongly inflated.

We believe it to be extremely probable that the male, recorded by Griffini as *Caulonia molita* (Westwood),[34] from Lake Pita, Darien, Panama, represents the present species. The male of true *molita* may be distinguished by the much smoother surface, cerci which are more slender distad, eight tergite without a projection of the latero-caudal angles ventrad and longer and more specialized eighth sternite.

*Type*.—♂; Paraiso, Canal Zone, Panama. January 23, 1911. (E. A. Schwarz.) [United States National Museum.]

Size medium, form slender, as is usual in this sex of species of *Libethra*. Head as long as pronotum, occiput slightly swollen caudad, with scattered granules and a fine medio-longitudinal line, a slightly larger granule on each side caudad on the swollen area. Pronotum with very weak scattered granules and a fine medio-longitudinal line, the transverse sulcus distinct, on each side sending as strong a sulcus to the cephalic margin, paralleling the lateral margins. Mesonotum with weak scattered granules in cephalic two-thirds, the medio-longitudinal line subcarinulate and continued on metanotum, which is otherwise smooth. Tergites showing traces of four fine longitudinal carinae, these becoming distinct on caudal portion of fifth and all of sixth tergites, the three succeeding tergites strongly medio-longitudinally carinate, the seventh expanding with sides showing additional carinae, the eighth strangulate, the ninth cucullate, slightly broader than long, on each side with surface dorso-

[33] Insektenfamilie der Phasmiden, p. 307, (1907). The description is, as usual in that work, thoroughly unsatisfactory, omitting any definite genitalic diagnosis and other features by which the species is probably best distinguished. As a result we believe that *panamae* actually shows decidedly more striking features of difference than we can give without material for comparison.

[34] Boll. Mus. Zool. Anat. Comp. Univ. Torino, xi, no. 236, p. 9, (1896).

proximad strongly swollen and convex. Cerci short, stout, irregularly flattened, curving inward and distad tapering to their bluntly rounded apices. Ventral surface smooth. Fourth and fifth sternites distad with two, short, parallel ridges; these weakly indicated on the preceding sternites. Sixth sternite short, seventh large, projecting, with surface convex, medio-longitudinally carinate with apex produced like the very narrow spout of a pitcher, enlarged portion with a sharply rounded projection on each side proximad. Limbs wholly unspecialized.

*Allotype.*—(juv.?) ♀; Old Panama, Panama. January 31, 1911. (E. A. Schwarz.) [United States National Museum.]

Agrees closely with male except as follows. Shorter (due to immaturity ?), form much more robust. Granulation on mesonotum more decided and thicker, similar on metanotum. Abdomen dorsad with seven fine, nearly longitudinal carinae, the lateral margins with granules and the carinulae with these particularly on sixth and seventh tergites; second tergite with caudal extremities of four median carinae each elevated in a rounded tooth; sixth tergite elevated mesad in a small bidenticulate process with apices rounded; eighth and nine tergites tectate and showing two weak carinulae on each side, eighth with latero-caudal angles very broadly rounded, ninth minutely but deeply U-emarginate above the minute supra-anal plate, the acute projections thus formed with apices rounded. Ventral surface with subobsolete granules and carinae, a pair of the latter becoming distinct on the abdominal sternites. Operculum flattened, strongly carinulate proximad on each side, distad with lateral margins convergent and weakly convex to the deeply U-emarginate meso-distal area, which leaves two slender, straight, finger-like apices. Cephalic femora dilated dorsad with dorsal margin showing a number of weak but distinct undulations. Median femora with dorso-caudal margin bearing two minute rounded-triangular lobes proximad, dorso-cephalic margin showing traces of similar development as do the dorso-caudal margins of the caudal femora.

General coloration of male saccardos umber. Antennae, caudal limbs and brief proximal portions of cephalic and median femora paler. Head with ventral surface and a suffused postocular streak of darker coloration. Female uniform clay color, showing a tawny tinge. Head with a suffused postocular darker streak feebly indicated.

Male, *type*. Length of body, 59; length of mesonotum, 7; median width of mesonotum, 1.8; length of metanotum (including median segment), 11.2; length of median segment, 1.4; length of cephalic femur, 18.6; length of median femur, 13.8; length of caudal femur, 17.8; length of cephalic tibia, 20.7 mm.

The female, *allotype*, though structurally apparently adult, is so much smaller that it may represent one of the later stages of immaturity. Length of body, 52.5; length of mesonotum, 14.3; median width of mesonotum, 3;

length of metanotum (including median segment), 9.2; length of median segment, 1.8; length of cephalic femur, 14.2; length of median femur, 10.3; length of caudal femur, 11.8; length of operculum, 5.8 mm.

This species is known to us only from the pair here described.

### ONCOTOPHASMA Rehn

1904. *Oncotophasma* Rehn, Proc. Acad. Nat. Sci. Phila., 1904, p. 59.
1907. *Paradiapheromera* Brunner, Insektenfamilie der Phasmiden, p. 317.

The type by monotypy of *Oncotophasma* is Griffini's *martini*. We here select as genotype of *Paradiapheromera*, Brunner's *strumosa*. As that species is a synonym of *martini*, *Paradiapheromera* consequently falls as a synonym of *Oncotophasma*. Brunner's lack of knowledge of recent literature here resulted in his overlooking the work of both Griffini and Rehn.

**Oncotophasma martini** (Griffini)

1896. *B[ostra] martini* Griffini, Boll. Mus. Zool. Anat. Comp. Univ. Torino, XI, no. 236, p. 10, figs. a, b and c. [♂; Lake Pita, Darien, Panama.]
1907. *Paradiapheromera strumosa* Brunner, Insektenfamilie der Phasmiden, p. 317. [♂: Chiriqui, [Panama] (nec Peru); Darien.]

Porto Bello, Panama, III, 6, 1911, (Busck), 1 ♂.

Alhajuelo, Pan., IV, 18, 1911, (Busck), 1 juv. ♀.

Gatun, Canal Zone, Pan., VII, 17 to VIII, 22, 1916, (Harrower), 6 ♂.

The comparatively slender, smooth and apterous males of this insect are readily distinguished by the remarkable swelling, which occupies the caudal portion of the metanotum.

The extremes in the Gatun series of this very distinctive species measure as follows:

Length of body, 83 to 92; length of mesonotum, 21.4 to 24.9; median width of mesonotum, 1.7 to 2; length of metanotum (including median segment), 14 to 15.8; length of median segment, 4 to 4.8; width of median swelling, 5 to 5.8; length of cephalic femur, 23.8 to 28.1; length of median femur, 18.5 to 22; length of caudal femur, 26 to 29; length of cephalic tibia, 26.7 to 31.5 mm.

## PHIBALOSOMINAE

### TRYCHOPEPLUS Shelford

1908. *Pericentrus* Redtenbacher (in part), Monographie der Phasmiden, p. 351.
1908. *Trychopeplus* Shelford, Biol. Cent.-Amer., Orth., II, pl. 6, fig. 5.

Redtenbacher's *Pericentrus* clearly includes several distinct generic units. One of these includes the species *multilobatus* Redtenbacher, genotype by monotypy of Shelford's *Trychopeplus*, which species is a synonym of *Ceroys laciniatus* Westwood.[35] To *Trychopeplus* probably also belongs *spinoso-lobatus* (Redtenbacher).

We are, in another paper, removing from *Pericentrus*, as understood by Redtenbacher, the remaining American species, *restrictus* of Redtenbacher, described from Porto Rico.

This leaves in the genus *Pericentrus* Redtenbacher, five Asiatic and Melanesian species, of which we select as genotype, *Pericentrus möwisi* Redtenbacher, described and figured, from Sikkim.

The genus *Trychopeplus* may be distinguished from *Pericentrus*, as limited above, by the much longer tarsi, of which the metatarsus is as long as, or longer, than the combined length of the succeeding joints. The males are known for *Trychopeplus* only and in this genus have fully developed organs of flight. We are confident that comparison with material of *Pericentrus möwisi* would show a number of other, fully as important, features for generic separation from *Trychopeplus laciniatus*.

**Trychopeplus laciniatus** (Westwood) (Plate XV, figures 5 and 6.)

1874. *Ceroys laciniatus* Westwood, Thesaur. Ent. Oxoniensis, p. 174, pl. xxxii, fig. 4. [[♀], Nicaragua.]

1908. *Pericentrus multilobatus* Redtenbacher (in part), Monographie der Phasmiden, p. 352. [♂:[36] Chiriqui, [Panama]; [Rio Sucio], Costa Rica.]

1908. *Pericentrus laciniatus* Shelford, Biol. Cent.-Amer., Orth., II, p. 356. [♀, Nicaragua: ♂, Rio Sucio, Costa Rica; Chiriqui and Bugaba, Panama.]

1908. *Trychopeplus multilobatus* Shelford, Biol. Cent.-Amer., Orth., II, pl. VI, fig. 5. (Male.)

[35] Shelford has pointed out that the male of Redtenbacher's *Pericentrus multilobatus* represents the opposite sex of Westwood's *Ceroys laciniatus*. He has, however, attempted to retain the name *multilobatus* for the immature female from Peru, described by Redtenbacher. This can not be done, as that specimen was referred to *multilobatus* with a query and the type of *multilobatus* must consequently be one of the described males. We here select as type of *Pericentrus multilobatus* Redtenbacher, the male from Chiriqui, Panama. As a result, that name falls as a synonym of *Trychopeplus laciniatus* (Westwood).

[36] The immature Peruvian female described by Redtenbacher, represents a distinct species for which a name is, at the present time, not available.

Rio Trinidad, Panama, III, 29, 1912, (Busck), 1 small juv.; V, 1911, (Busck), 1 ♀, eggs.

The irregular, foliaceous lamellae of the body and limbs of this very remarkable insect, like the long silky hairs on its eggs, must closely resemble the mossy environment in which the species probably lives.

**Bacteria ploiaria** (Westwood)

1859. *Phibalosoma ploiaria* Westwood, Cat. Orth. Ins. British Mus., I, Phasmidae, p. 79, pl. XIII, fig. 4. [♂; "In plagis occid. Amer. Septentrion."]

1908. *B[acteria] subvolans* Redtenbacher, Insektenfamilie der Phasmiden, p. 416. [♂, Chiriqui, Panama.]

Gatun, Canal Zone, Panama, 1912, (Zetek), 1 ♂, [Hebard Cln.].

Canal Zone, Pan., (Jennings), 1 ♂.

Panama, Pan., (Zetek), 1 ♀, [Hebard Cln.].

The two males before us are unquestionably conspecific, one having elongate wings, the other with these organs slightly surpassing the median segment. The latter condition was described as *subvolans* by Redtenbacher, the material before us showing that name to be based on such individual variation and consequently of no value.

The previously unknown female may be described as follows. Vertex weakly bituberculate, much as in male but with tuberculations proportionately not as heavy. The metatarsi are cristate, as in *B. remphan* Westwood. The mesonotum is granulose and weakly tectate. The median and caudal femora are simple, except for a low lobe proximad on the ventro-caudal margin of the sinistral median femur. The lobes of the limbs and abdomen are subject to great individual variation in many species of this and allied genera. The genitalia are much as figured by Westwood for *remphan*, except that the operculum and the ultimate tergite reach an equal distance caudad, the former not considerably surpassing the latter, while the sixth tergite has the ventro-caudal portions laterad produced in an elongate rounded lobe, which does not project beyond the caudal margin of the tergite.

Length of body, ♂ 115 and 120.5, ♀ 173; length of mesonotum, ♂ 31 and 31.8, ♀ 41; median width of mesonotum, ♂ 1.7 and

1.7, ♀ 5.7; length of metanotum (including median segment), ♂ 18 and 19, ♀ 24.8; length of median segment, ♂ 14 and 14.8, ♀ 15.7; length of tegmen, ♂ 6.2 and 5.9, ♀ absent; length of wing, ♂ 18.1 and 33.3, ♀ absent; length of cephalic femur, ♂ (missing) and 37, ♀ 39.8; length of caudal femur, ♂ 30.8 and 36, ♀ 39; length of cephalic tibia, ♂ (missing) and 46.2, ♀ 43.8; length of operculum, 14.9 mm.

**Pterinoxylus spinulosus** Redtenbacher

1908. *Pt[erinoxylus] spinulosus* Redtenbacher, Monographie der Phasmiden, p. 428, pl. xx, fig. 3. [♂; Chiriqui, Panama.]

Panama, 1 ♂, [U. S. N. M.].

The spination and lamellation of the limbs is more irregular in this insect than would be expected from Redtenbacher's figure. The specimen before us is slightly smaller, but agrees closely with the type. The pair of long sharp spines at the caudal margin of the pronotum are conspicuous.

## Explanation of Plates

### Plate XIV

Fig. 1.—*Brizoides annulicornis* new species. Dorsal view of female. Porto Bello, Panama. *Type.* (Natural size.)

Fig. 2.—*Brizoides annulicornis* new species. Lateral view of distal portion of female abdomen. Porto Bello, Panama. *Type.* (Much enlarged.)

Fig. 3.—*Prisopus ariadne* new species. Ventral view of portion of male abdomen, to show distinctive marking. Alhajuela, Panama. *Allotype.* (× 3½)

Fig. 4.—*Prisopus ariadne* new species. Dorsal view of base of female sinistral tegmen, to show distinctive nodes. Carillo, Costa Rica. *Type.* (× 4)

Fig. 5.—*Prisopus ariadne* new species. Dorsal outline of female tegminal shoulder. Carillo, Costa Rica. *Type.* (Much enlarged.)

Fig. 6.—*Prisopus ariadne* new species. Dorsal view of male tegminal shoulder, to show diversity between sexes (compare figure 5). Alhajuela, Panama. *Allotype.* (Same scale as figure 5.)

Fig. 7.—*Prisopus ariadne* new species. Lateral outline of female cephalic femur. Carillo, Costa Rica. *Type.* (× 3)

Fig. 8.—*Prisopus ariadne* new species. Lateral outline of female caudal femur. Carillo, Costa Rica. *Type.* (× 3)

Fig. 9.—*Libethra panamae* new species. Ventral view of distal portion of female abdomen. Old Panama, Panama. *Allotype.* Immature? (Much enlarged.)

### Plate XV

Fig. 1.—*Pseudoceroys harroweri* new species. Dorsal view of female. Porto Bello, Panama. *Type.* (× 1½)

Fig. 2.—*Pseudoceroys harroweri* new species. Lateral view of head of female. Porto Bello, Panama. *Type.* (× 4½)

Fig. 3.—*Libethra panamae* new species. Dorsal view of distal portion of male abdomen. Paraiso, Canal Zone, Panama. *Type.* (× 5)

Fig. 4.—*Libethrae panamae* new species. Lateral view of distal portion of male abdomen. Paraiso, Canal Zone, Panama. *Type.* (× 5)

Fig. 5.—*Trychopeplus laciniatus* (Westwood). Dorsal view of female. Rio Trinidad, Panama. (Natural size.)

Fig. 5.—*Trychopeplus laciniatus* (Westwood). Lateral view of egg from which the young has emerged (in unhatched eggs, the spiny portion is alone visible). Rio Trinidad, Panama. (× 5)

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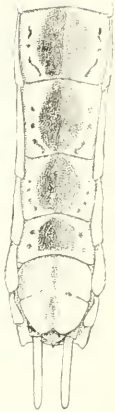
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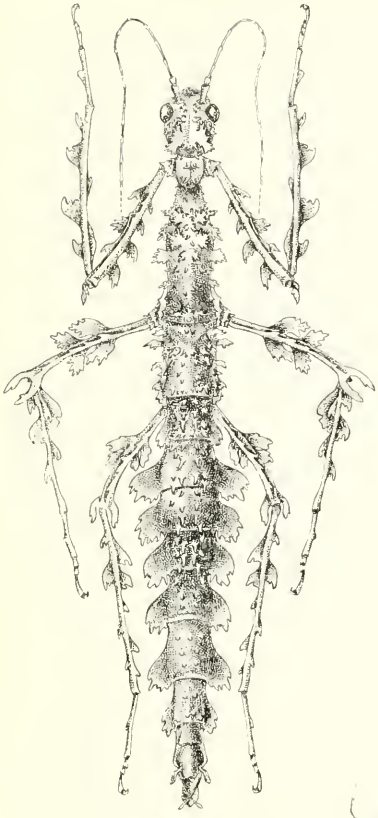

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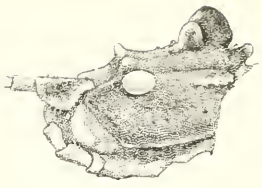

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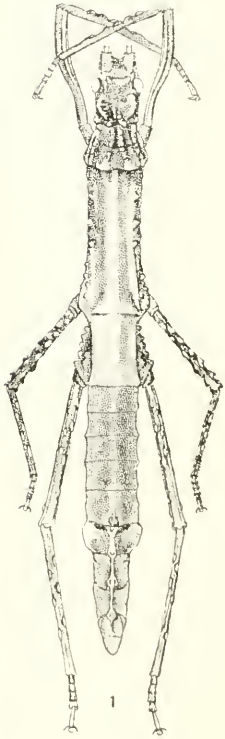

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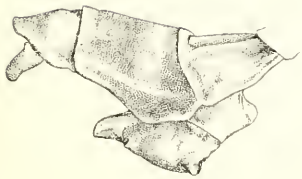

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